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Vortex Flap Flow Reattachment Line and Subsonic Longitudinal Aerodynamic Data on 50° to 74° Delta Wings on Common Fuselage

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SUMMARY

Positions of the primary vortex flow reattachment line and longitudinal aerodynamic data were obtained at Mach number 0.3 for a series of delta wing-body configurations with leading-edge sweeps of 50°, 58°, 66°, and 74° which incorporate vortex flaps. The investigation was performed to study the parametric effects of wing sweep, geometry and deflection of vortex flaps, canards, and trailing-edge flaps on the location of the primary vortex reattachment line relative to the flap hinge line. The vortex reattachment line was located through surface oil flow photographs taken at selected angles of attack. Both the flow reattachment and aerodynamic data are presented.

INTRODUCTION

Delta wings have been studied extensively for their potential performance benefits at supersonic speeds. At the high angles of attack necessary for takeoff, landing, and maneuver, the slender wing planforms develop leading-edge vortex flow, particularly if the leading edge is sharp. This separation-induced vortex flow is useful for generating large increments of nonlinear lift, but this is unfortunately accompanied by a substantial increase in lift-dependent drag caused by the loss of leading-edge suction. The vortex flap concept, illustrated in figure 1, is a means to generate substantial reductions in induced drag by "capturing" the leading-edge vortex along a forward-facing deflection surface. When the flap is properly designed, flow reattachment takes place along the hinge line; this results in an efficient distribution of thrust which produces suction pressures on the flap surface (hence, drag reduction) and a smooth transition to attached flow on the wing upper surface.

The vortex flap concept has been explored experimentally and analytically for a range of swept-wing configurations (refs. 1 to 9). However, a need still exists to better understand parameters and flow phenomenon that affect the position of the flow reattachment line. Thus, the present investigation was undertaken to study the parametric effects of wing sweep, geometry and deflection of vortex flaps, canards, and trailing-edge flaps on the location of the primary vortex reattachment line relative to the flap hinge line. Longitudinal aerodynamic quantities were also measured for a majority of configurations.

This paper is a compilation of basic vortex flow reattachment and longitudinal aerodynamic data for a systematic series of vortex flaps on a delta wing-body configuration with leading-edge sweeps of 50°, 58°, 66°, and 74°. The test was conducted in the Langley 7- by 10-Foot High-Speed Tunnel at a free-stream Mach number of 0.3 and a Reynolds number of 2.0×10^6 per foot.

SYMBOLS AND ABBREVIATIONS

The aerodynamic data are referred to the stability axis system with the exception of the normal- and axial-force coefficients, which are referred to the body axis system. Terms in parentheses are the symbols used in computer-generated tables.

A		aspect ratio
b		wing span, in.
C_A	(CA)	axial-force coefficient, $\frac{\text{Axial force}}{q_\infty S_{ref}}$
C_D	(CD)	drag coefficient, $\frac{\text{Drag}}{q_\infty S_{ref}}$
C_L	(CL)	lift coefficient, $\frac{\text{Lift}}{q_\infty S_{ref}}$
C_N	(CN)	normal-force coefficient, $\frac{\text{Normal force}}{q_\infty S_{ref}}$
C_Y	(CYS)	side-force coefficient, $\frac{\text{Side force}}{q_\infty S_{ref}}$
C_l	(CRMS)	rolling-moment coefficient, $\frac{\text{Rolling moment}}{q_\infty S_{ref} b}$
C_m	(CMS)	pitching-moment coefficient, $\frac{\text{Pitching moment}}{q_\infty S_{ref} \bar{c}}$
C_n	(CYMS)	yawing-moment coefficient, $\frac{\text{Yawing moment}}{q_\infty S_{ref} b}$
$\bar{c}$		wing reference chord, in.
c_r		wing root chord at wing-fuselage abutment, in.
LEVF		leading-edge vortex flap
Mod		modification
q_∞	(Q)	free-stream dynamic pressure, psf
S_{LEVF}		area of leading-edge vortex flap (both flaps), in^2
S_{ref}		wing reference area, in^2
s'_h		local semispan of hinge line measured from fuselage side (see fig. 12), in.
t/c		local thickness-chord ratio
WCP		wing chord plane

x	longitudinal position of primary vortex reattachment line (see fig. 12), in.
y	spanwise position of primary vortex reattachment line measured from fuselage side (see fig. 12), in.
α	angle of attack, deg
δ_{LE}	LEVF deflection angle normal to hinge line and with respect to WCP, deg
δ_{TE}	trailing-edge flap deflection angle with respect to WCP, deg
Λ_h	LEVF hinge-line sweep angle, deg

MODEL DESCRIPTION

Pertinent geometric characteristics associated with this model are summarized in table I. A drawing of the general research fighter fuselage and vertical tail used for this test, with a typical delta wing installed, is shown in figure 2. The flap apex angle of 29° is common to the constant-chord flap for each wing sweep. Presented in figures 3 through 6 are details of the delta wing series and flap geometries tested. The flap planforms tested on the 58° delta configuration are defined in figure 4(b). Coordinates for the gothic flap tested on the 74° delta model are given in table II.

All constant-chord flaps were fabricated as a part of the original wing and could be deflected ±40°. The gothic flaps of figures 4(b) and 6 were fabricated from sheet aluminum and nominally beveled to a sharp edge. The gothic flap of figure 4(b) was mounted to the wing with fixed brackets, whereas the one in figure 6 was fastened to the original wing flap hinges. Both sets of flaps were contoured to the wing upper surface with a filler compound. The modified gothic flaps in figure 4(b) were derived by progressively cutting the original gothic flap as directed by Dhanvada M. Rao in reference 10. All flaps tested were integrally mounted and their areas included in the reference area.

A typical configuration installed in the Langley 7- by 10-Foot High-Speed Tunnel is shown in figure 7. The line patterns on the flaps were placed for reference when measuring positions of the reattachment line from oil flow photographs.

APPARATUS, TESTS, AND CORRECTIONS

The investigation was conducted in the Langley 7- by 10-Foot High-Speed Tunnel. (See ref. 11.) Forces and moments were measured by a six-component strain-gage balance. Surface flow patterns were visualized by coating the model with a mixture of oil and fluorescent powder. The flow velocity was then brought to steady state with the model at zero angle of attack before the angle of attack was increased to the desired value. Once the flow patterns stabilized, photographs were taken under ultraviolet strobe lights.

Tests were conducted at a free-stream Mach number of 0.3 which corresponds to free-stream Reynolds numbers of 1.3×10^6, 1.8×10^6, 2.5×10^6, and 3.9×10^6 based

on the mean aerodynamic chords for the 50°, 58°, 66°, and 74° delta wings, respectively. The model was tested at zero sideslip over a range angle of attack of -1° to 22°. Tests were conducted with a 1/8-in. strip of No. 90 grit applied 1.0 in. aft chordwise from the leading edge of the flap, canard, and vertical tail and No. 100 grit applied 1.0 in. aft of the fuselage nose as outlined in reference 12.

The data are corrected for jet boundary and blockage effects as computed from references 13 and 14, respectively. Angle-of-attack corrections for sting and balance deflection under load have also been applied to the data. Axial force is corrected to a condition of free-stream static pressure acting over the aft fuselage base area and within the fuselage housing.

PRESENTATION OF RESULTS

A summary of the test configurations is presented in table III. Figure numbers for the basic longitudinal aerodynamic data plots (figs. 8 through 11) are included in table III, along with the run numbers associated with the tabulated aerodynamic data in table IV. The aerodynamic reference areas are defined by extending the leading edge of the constant-chord flaps and the wing trailing-edge inboard to the centerline.

The positions of the vortex flow reattachment line were determined from surface oil flow photographs. A representative case is shown in figure 12, where the primary vortex reattachment line is indicated by a dashed line. Sketches of the positions of the reattachment line observed during the test were also used to aid in interpretation of the photographs. The positions of the reattachment line were quantified by digitizing them directly from the photographs. Because the primary interest was in the position of the reattachment line relative to the hinge line, the spanwise coordinate y was nondimensionalized by the local exposed hinge semispan s'_h. (See fig. 12.) Thus, values for $y/s'_h > 1$ correspond to reattachment on the flap, and values for $y/s'_h < 1$ correspond to reattachment on the wing. It should be noted that the digitized values of the reattachment line reflect the projected location on the deflected flap. By employing standard coordinate transformations, the actual positions can be determined. The reattachment line data presented in figures 13 through 20 are arranged for the reader to easily discern parametric trends associated with angle of attack, flap geometry and deflection, canards, and trailing-edge flaps. Consistent symbols are therefore maintained for a set of figures corresponding to a particular wing sweep.

CONCLUDING REMARKS

The positions of the primary vortex flow reattachment line and longitudinal aerodynamic data were obtained at Mach number 0.3 for a systematic series of vortex flaps on a series of delta wing-body configurations with leading-edge sweeps of 50°, 58°, 66°, and 74°. The reattachment line data are arranged for the reader to easily discern parametric trends associated with angle of attack, geometry and deflection of vortex flap, canards, and trailing-edge flaps. Longitudinal aerodynamic quantities were also measured for a majority of configurations.

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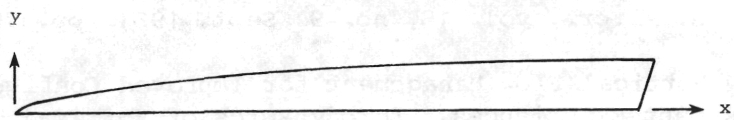
TABLE I.- GEOMETRIC CHARACTERISTICS OF MODEL

Λ_h, deg	S_{ref}, in^2	$\bar{c}$, in.	LEVF planform	b, in.	A	S_{LEVF}/S_{ref}, percent	Figure
50	119.18	7.94	Constant chord	20.00	3.36	17.98	3
58	160.03	10.67	Constant chord	20.00	2.50	19.56	4(a)
58	160.03	10.67	Constant chord with extension	20.00	2.50	22.82	4(b)
58	160.03	10.67	Gothic	20.04	2.51	19.07	4(b)
58	160.03	10.67	Gothic - Mod 1	20.04	2.51	14.97	4(b)
58	160.03	10.67	Gothic - Mod 2	20.04	2.51	14.25	4(b)
58	160.03	10.67	Gothic - Mod 3	20.04	2.51	12.10	4(b)
66	224.60	14.97	Constant chord	20.00	1.78	21.07	5
74	348.74	23.25	Constant chord	20.00	1.15	22.92	6
74	348.74	23.25	Gothic	20.50	1.20	20.13	6

TABLE II.- PLANFORM COORDINATES OF GOTHIC FLAP
TESTED ON 74° DELTA CONFIGURATION



x, in.	y, in.	x, in.	y, in.
0.000	0.000	5.438	1.064
.180	.118	6.699	1.182
.449	.236	8.144	1.300
.817	.355	9.808	1.418
1.289	.473	11.739	1.537
1.870	.591	14.022	1.655
2.567	.709	16.819	1.773
3.387	.827	20.572	1.891
4.340	.946	24.866	1.970

TABLE III.- SUMMARY OF TEST CONFIGURATIONS

Λ_h, deg	LEVF planform	δ_{LE}, deg	δ_{TE}, deg	Canard	Run	Figure
Aerodynamic data						
50	Constant chord	0	0		1	8(a)
	Constant chord	40	0		4	8(b)
58	Constant chord	0	0		11	9(a)
	Constant chord	40	0		14	9(b)
	Constant chord with extension	30	0		42	9(c)
	Constant chord with extension	40	0		43	9(d)
	Constant chord	0	0	Mid	26	9(e)
	Constant chord	40	0	Mid	27	9(f)
	Constant chord	0	0	High	31	9(g)
	Constant chord	40	0	High	32	9(h)
	Gothic	0	0		21	9(i)
	Gothic	40	0		24	9(j)
	Gothic - Mod 1	40	0		44	9(k)
	Gothic - Mod 2	40	0		45	9(l)
	Gothic - Mod 3	40	0		46	9(m)
66	Constant chord	0	0		6	10
74	Constant chord	0	0		16	11(a)
	Constant chord	40	0		19	11(b)
	Constant chord	40	20		20	11(c)
	Gothic	0	0		36	11(d)
	Gothic	30	0		41	11(e)
	Gothic	40	0		39	11(f)
	Gothic	40	20		40	11(g)
Reattachment data						
50	Constant chord	20	0			13(a)
	Constant chord	30	0			13(b)
	Constant chord	40	0			13(c)
	Constant chord	30	0			13(d)
58	Constant chord	0	0			14(a)
	Constant chord	20	0			14(b)
	Constant chord	30	0			14(c)
	Constant chord	40	0			14(d)
	Constant chord	30	20			14(e)
	Constant chord	0	0	Mid		15(a)
	Constant chord	40	0	Mid		15(b)
	Constant chord	0	0	High		15(c)
	Constant chord	40	0	High		15(d)
	Constant chord with extension	30	0			16(a)
	Constant chord with extension	40	0			16(b)
	Gothic	40	0			17(a)
	Gothic - Mod 1	40	0			17(b)
	Gothic - Mod 2	40	0			17(c)
	Gothic - Mod 3	40	0			17(d)
66	Constant chord	20	0			18(a)
	Constant chord	30	0			18(b)
	Constant chord	40	0			18(c)
	Constant chord	30	20			18(d)
74	Constant chord	20	0			19(a)
	Constant chord	30	0			19(b)
	Constant chord	40	0			19(c)
	Constant chord	40	20			19(d)
	Gothic	0	0			20(a)
	Gothic	30	0			20(b)
	Gothic	40	0			20(c)
	Gothic	40	20			20(d)

TABLE IV.- TABULATED AERODYNAMIC DATA

TEST 105 RUN 1

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.8	.00	.0115	.0197	-.0013	.0021	-.0018	-.0018	.0115	.0197
.301	126.4	-.89	-.0293	.0199	-.0028	.0019	-.0018	.0007	-.0296	.0195
.301	126.1	.02	.0160	.0184	-.0014	.0024	-.0019	-.0000	.0160	.0184
.300	126.1	1.97	.1094	.0205	.0042	.0018	-.0020	-.0010	.1100	.0167
.301	126.6	3.86	.2105	.0273	.0100	.0015	-.0025	-.0013	.2118	.0130
.301	126.3	5.78	.3087	.0415	.0166	.0012	-.0025	-.0029	.3113	.0102
.301	126.4	7.79	.4069	.0631	.0273	.0009	-.0029	-.0025	.4117	.0073
.301	126.4	9.57	.4866	.0872	.0368	.0006	-.0032	-.0035	.4943	.0051
.301	126.2	11.58	.5652	.1209	.0465	.0003	-.0038	-.0047	.5779	.0049
.300	125.5	13.54	.6522	.1615	.0514	.0001	-.0047	-.0053	.6719	.0043
.301	126.1	15.49	.7265	.2103	.0463	-.0006	-.0054	-.0058	.7563	.0087
.301	126.6	17.42	.7728	.2596	.0340	-.0014	-.0055	-.0062	.8151	.0163
.301	126.2	19.29	.7760	.2947	.0357	-.0026	-.0050	-.0065	.8297	.0218
.300	125.8	21.18	.7859	.3299	.0413	-.0029	-.0052	-.0071	.8521	.0236
.300	125.6	.02	.0269	.0210	-.0036	.0013	-.0023	.0010	.0269	.0210

TEST 105 RUN 4

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.7	-.04	-.1039	.0667	-.0130	.0023	-.0015	-.0008	-.1040	.0667
.300	126.0	-.95	-.1462	.0737	-.0152	.0020	-.0012	.0005	-.1474	.0713
.301	126.3	-.05	-.1030	.0657	-.0130	.0023	-.0013	.0004	-.1031	.0656
.301	126.7	1.89	-.0105	.0524	-.0046	.0022	-.0016	-.0003	-.0087	.0527
.301	126.4	3.77	.0768	.0452	.0018	.0017	-.0018	-.0006	.0796	.0400
.301	126.4	5.68	.1788	.0424	.0082	.0018	-.0023	-.0025	.1822	.0245
.300	125.9	7.66	.2761	.0473	.0160	.0012	-.0025	-.0037	.2800	.0101
.301	126.1	9.51	.3684	.0539	.0208	.0008	-.0027	-.0034	.3722	-.0078
.300	125.6	11.53	.4637	.0672	.0266	.0009	-.0031	-.0042	.4678	-.0268
.299	125.0	13.48	.5511	.0847	.0328	.0010	-.0034	-.0052	.5557	-.0461
.300	125.9	15.44	.6380	.1056	.0406	.0011	-.0041	-.0055	.6430	-.0681
.300	125.4	17.44	.7270	.1311	.0483	.0009	-.0048	-.0068	.7328	-.0929
.301	126.6	19.27	.8079	.1600	.0549	.0013	-.0059	-.0067	.8155	-.1156
.300	125.7	21.30	.8922	.1999	.0624	.0009	-.0075	-.0085	.9038	-.1378
.300	125.3	-.04	-.1038	.0660	-.0116	.0019	-.0009	.0001	-.1038	.0660

TEST 105 RUN 6

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.2	.00	.0043	.0105	.0002	.0008	-.0012	.0000	.0043	.0105
.300	125.5	-.87	-.0190	.0105	-.0001	.0011	-.0010	.0008	-.0192	.0102
.300	125.8	.04	.0037	.0098	.0003	.0008	-.0010	.0006	.0037	.0098
.301	126.7	1.97	.0689	.0117	.0011	.0012	-.0010	-.0006	.0693	.0093
.301	126.4	3.92	.1443	.0182	.0020	.0009	-.0010	-.0007	.1452	.0082
.301	126.7	5.81	.2203	.0293	.0024	.0008	-.0012	-.0021	.2222	.0069
.301	126.7	7.76	.2983	.0461	.0043	.0010	-.0016	-.0020	.3018	.0054
.301	126.4	9.70	.3777	.0683	.0071	.0010	-.0020	-.0023	.3838	.0037
.300	125.9	11.71	.4646	.0988	.0090	.0006	-.0026	-.0034	.4750	.0025
.299	125.1	13.66	.5569	.1361	.0100	.0004	-.0034	-.0042	.5733	.0007
.301	126.2	15.67	.6466	.1808	.0105	-.0001	-.0042	-.0049	.6714	-.0006
.300	125.6	17.70	.7425	.2344	.0113	-.0006	-.0053	-.0054	.7786	-.0025
.301	126.5	19.59	.8273	.2902	.0100	-.0011	-.0066	-.0062	.8767	-.0040
.301	126.3	21.59	.9139	.3553	.0073	-.0023	-.0076	-.0070	.9805	-.0059
.302	127.0	.01	.0168	.0130	-.0032	.0001	-.0013	.0008	.0168	.0130

TEST 105 RUN 11

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.5	.00	.0093	.0125	-.0010	.0018	-.0012	-.0000	.0093	.0125
.300	125.3	-.91	-.0270	.0114	-.0022	.0021	-.0012	.0006	-.0272	.0110
.300	125.4	.01	.0099	.0108	-.0009	.0020	-.0010	.0009	.0099	.0108
.301	125.7	1.98	.0892	.0149	.0009	.0018	-.0013	-.0001	.0897	.0118
.298	123.6	3.85	.1774	.0214	.0039	.0018	-.0014	-.0003	.1784	.0095
.301	125.7	5.72	.2617	.0342	.0067	.0015	-.0016	-.0015	.2638	.0079
.301	125.8	7.73	.3575	.0543	.0109	.0013	-.0016	-.0014	.3616	.0058
.301	125.6	9.63	.4409	.0791	.0168	.0011	-.0019	-.0022	.4479	.0042
.300	125.0	11.60	.5300	.1117	.0214	.0009	-.0024	-.0031	.5416	.0029
.300	125.0	13.56	.6191	.1518	.0249	.0007	-.0030	-.0035	.6374	.0024
.301	125.8	15.53	.6950	.1954	.0283	-.0002	-.0036	-.0043	.7220	.0021
.301	125.5	17.54	.7726	.2475	.0269	-.0005	-.0046	-.0052	.8113	.0031
.300	125.0	19.39	.8546	.3048	.0170	-.0008	-.0058	-.0055	.9073	.0038
.300	124.9	21.36	.9346	.3738	-.0030	-.0030	-.0061	-.0064	1.0066	.0076
.300	125.4	-.01	.0269	.0176	-.0077	.0008	-.0011	.0015	.0269	.0176

TABLE IV.- Continued

TEST 105 RUN 14

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.3	-.06	-.0968	.0489	-.0121	.0021	-.0011	.0002	-.0968	.0488
.300	125.0	-.94	-.1319	.0543	-.0146	.0021	-.0010	.0002	-.1328	.0521
.301	125.8	-.03	-.0939	.0474	-.0129	.0019	-.0011	-.0002	-.0939	.0473
.302	126.6	1.88	-.0070	.0365	-.0099	.0018	-.0011	-.0001	-.0058	.0367
.300	124.9	3.87	.0815	.0307	-.0071	.0016	-.0010	.0001	.0833	.0252
.301	126.1	5.68	.1631	.0311	-.0055	.0017	-.0012	-.0014	.1654	.0148
.301	126.0	7.71	.2491	.0354	-.0032	.0017	-.0015	-.0017	.2516	.0017
.300	125.2	9.58	.3256	.0448	-.0013	.0019	-.0018	-.0020	.3286	-.0100
.300	125.2	11.55	.4006	.0600	.0011	.0015	-.0022	-.0040	.4045	-.0214
.299	124.5	13.56	.4840	.0773	.0029	.0019	-.0027	-.0039	.4886	-.0384
.302	126.5	15.46	.5618	.0941	.0046	.0020	-.0032	-.0049	.5665	-.0590
.300	125.3	17.49	.6436	.1187	.0068	.0010	-.0035	-.0051	.6496	-.0802
.300	124.7	19.34	.7215	.1495	.0065	.0006	-.0043	-.0062	.7303	-.0979
.301	126.0	21.32	.8035	.1935	.0100	-.0000	-.0046	-.0066	.8189	-.1118
.300	124.8	-.03	-.0826	.0482	-.0184	.0014	-.0004	.0014	-.0827	.0482

TEST 105 RUN 16

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.5	.00	.0047	.0086	-.0003	.0009	-.0007	-.0002	.0047	.0086
.300	125.6	-.89	-.0145	.0076	-.0001	.0008	-.0006	.0003	-.0146	.0074
.300	125.7	.03	.0051	.0069	-.0003	.0012	-.0007	.0001	.0051	.0069
.300	125.2	1.99	.0535	.0093	-.0009	.0011	-.0007	-.0005	.0538	.0074
.300	125.5	3.87	.1083	.0148	-.0020	.0011	-.0006	-.0006	.1090	.0074
.300	125.7	5.80	.1696	.0245	-.0033	.0011	-.0006	-.0010	.1712	.0073
.301	126.2	7.81	.2393	.0399	-.0045	.0011	-.0007	-.0015	.2425	.0070
.300	125.6	9.71	.3110	.0598	-.0057	.0011	-.0011	-.0020	.3166	.0064
.300	125.8	11.77	.3962	.0882	-.0069	.0009	-.0019	-.0023	.4059	.0055
.300	125.4	13.81	.4782	.1221	-.0080	.0004	-.0029	-.0033	.4935	.0045
.300	125.9	15.85	.5670	.1643	-.0089	.0001	-.0041	-.0038	.5903	.0033
.300	125.2	17.89	.6582	.2146	-.0093	-.0005	-.0051	-.0050	.6923	.0020
.300	125.6	19.81	.7373	.2663	-.0100	-.0013	-.0060	-.0055	.7839	.0006
.301	126.5	21.85	.7909	.3181	-.0051	-.0023	-.0064	-.0063	.8525	.0009
.300	125.5	.04	.0114	.0095	-.0014	.0008	-.0010	.0003	.0114	.0095

TEST 105 RUN 19

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.3	-.05	-.0385	.0164	-.0024	.0008	-.0006	.0002	-.0385	.0164
.301	125.9	-.97	-.0639	.0187	-.0025	.0012	-.0006	.0005	-.0642	.0176
.301	126.4	-.06	-.0412	.0158	-.0025	.0010	-.0006	.0004	-.0412	.0158
.301	125.9	1.97	.0152	.0118	-.0036	.0011	-.0005	-.0001	.0156	.0113
.301	126.4	3.80	.0614	.0112	-.0047	.0012	-.0005	-.0005	.0620	.0071
.300	125.7	5.72	.1068	.0139	-.0059	.0011	-.0005	-.0005	.1077	.0031
.300	125.9	7.67	.1540	.0195	-.0075	.0010	-.0005	-.0012	.1552	-.0012
.301	126.2	9.54	.2018	.0266	-.0086	.0011	-.0007	-.0015	.2034	-.0072
.300	125.8	11.58	.2585	.0374	-.0100	.0010	-.0010	-.0020	.2608	-.0152
.300	125.6	13.55	.3189	.0523	-.0125	.0008	-.0013	-.0024	.3222	-.0239
.301	126.0	15.54	.3863	.0730	-.0163	.0010	-.0024	-.0028	.3917	-.0332
.300	125.9	17.56	.4597	.1003	-.0205	.0006	-.0032	-.0032	.4686	-.0431
.301	126.4	19.50	.5278	.1313	-.0234	.0000	-.0039	-.0040	.5414	-.0524
.300	125.4	21.46	.5852	.1645	-.0233	-.0005	-.0044	-.0045	.6048	-.0610
.300	125.7	-.05	-.0341	.0163	-.0043	.0007	-.0007	.0005	-.0342	.0163

TEST 105 RUN 20

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.1	-.02	.1130	.0269	-.0551	.0012	.0003	-.0003	.1130	.0269
.300	125.4	-.96	.0873	.0269	-.0551	.0010	.0004	-.0002	.0868	.0283
.300	125.6	-.02	.1126	.0264	-.0548	.0012	.0003	-.0003	.1126	.0264
.301	126.1	1.93	.1616	.0279	-.0547	.0011	.0000	-.0005	.1625	.0224
.301	126.3	3.80	.1869	.0307	-.0534	.0012	-.0004	-.0009	.1885	.0182
.302	126.6	5.75	.2089	.0341	-.0518	.0010	-.0007	-.0010	.2113	.0130
.301	126.2	7.64	.2335	.0404	-.0507	.0010	-.0010	-.0010	.2368	.0090
.300	125.4	9.68	.2648	.0474	-.0492	.0009	-.0015	-.0017	.2690	.0022
.300	125.5	11.52	.2914	.0590	-.0473	.0009	-.0018	-.0017	.2973	-.0004
.298	124.2	13.47	.3228	.0750	-.0460	.0009	-.0023	-.0020	.3314	-.0023
.301	126.5	15.64	.3516	.0920	-.0427	.0007	-.0026	-.0024	.3634	-.0062
.300	125.4	17.47	.3828	.1096	-.0412	.0006	-.0030	-.0024	.3981	-.0104
.302	127.1	19.39	.4199	.1278	-.0375	-.0003	-.0034	-.0027	.4385	-.0189
.300	125.7	21.34	.4567	.1558	-.0354	-.0005	-.0036	-.0031	.4821	-.0211
.301	125.9	-.02	.1094	.0265	-.0537	.0012	-.0006	.0000	.1094	.0266

TABLE IV.- Continued

TEST 105 RUN 21

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	125.8	.01	.0120	.0124	.0004	.0009	-.0013	.0002	.0120	.0124
.300	125.7	-.93	-.0288	.0115	-.0011	.0014	-.0011	.0009	-.0290	.0111
.301	125.9	.00	.0114	.0111	.0006	.0009	-.0009	.0003	.0114	.0111
.301	125.8	1.94	.0909	.0137	.0028	.0012	-.0011	.0004	.0913	.0106
.301	126.1	3.83	.1760	.0199	.0052	.0012	-.0014	-.0008	.1770	.0081
.301	126.2	5.74	.2660	.0330	.0081	.0013	-.0016	-.0012	.2679	.0062
.301	125.9	7.77	.3640	.0540	.0130	.0012	-.0019	-.0018	.3679	.0043
.300	125.4	9.58	.4482	.0783	.0170	.0009	-.0023	-.0019	.4549	.0026
.301	126.1	11.64	.5384	.1126	.0226	.0007	-.0030	-.0032	.5501	.0016
.301	125.7	13.58	.6242	.1514	.0270	.0005	-.0032	-.0039	.6423	.0005
.300	125.6	15.55	.7023	.1960	.0291	-.0001	-.0036	-.0041	.7291	.0006
.298	123.7	17.50	.7776	.2465	.0271	-.0006	-.0041	-.0053	.8158	.0014
.301	126.1	19.41	.8608	.3061	.0154	-.0010	-.0047	-.0065	.9136	.0026
.300	125.3	21.36	.9284	.3708	-.0065	-.0030	-.0045	-.0069	.9997	.0071
.300	125.3	.00	.0245	.0158	-.0054	.0003	-.0014	.0008	.0245	.0158

TEST 105 RUN 24

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.3	-.05	-.0965	.0444	-.0077	.0009	-.0012	.0008	-.0966	.0443
.301	125.8	-.93	-.1345	.0494	-.0098	.0008	-.0010	.0008	-.1353	.0472
.301	126.0	-.02	-.0935	.0416	-.0078	.0009	-.0011	.0015	-.0936	.0415
.301	125.8	1.93	-.0063	.0315	-.0046	.0007	-.0011	.0004	-.0052	.0317
.301	126.3	3.89	.0812	.0260	-.0023	.0009	-.0011	-.0001	.0828	.0205
.300	125.4	5.77	.1699	.0248	-.0004	.0007	-.0014	-.0007	.1715	.0076
.301	126.0	7.68	.2514	.0293	.0023	.0002	-.0015	-.0014	.2530	-.0046
.301	125.9	9.56	.3279	.0361	.0042	.0003	-.0018	-.0024	.3294	-.0189
.300	125.5	11.55	.4072	.0491	.0067	.0008	-.0023	-.0025	.4088	-.0335
.301	126.1	13.52	.4910	.0656	.0087	.0006	-.0025	-.0034	.4927	-.0510
.300	125.1	15.49	.5743	.0874	.0122	.0011	-.0032	-.0039	.5768	-.0692
.300	125.3	17.48	.6532	.1147	.0156	.0009	-.0040	-.0044	.6575	-.0868
.300	125.3	19.39	.7371	.1514	.0178	.0010	-.0050	-.0052	.7456	-.1020
.301	126.1	21.35	.8245	.2021	.0211	-.0003	-.0049	-.0062	.8415	-.1119
.300	125.4	-.01	-.0816	.0436	-.0136	.0003	-.0005	.0008	-.0816	.0436

TEST 105 RUN 26

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.4	.01	.0120	.0152	-.0006	.0020	-.0017	-.0007	.0120	.0152
.301	126.1	-.92	-.0343	.0152	-.0069	.0026	-.0016	.0002	-.0345	.0147
.301	126.3	-.00	.0118	.0132	-.0016	.0020	-.0018	-.0003	.0118	.0132
.301	126.8	1.95	.1032	.0159	.0100	.0016	-.0022	-.0021	.1037	.0124
.301	126.2	3.86	.2074	.0241	.0261	.0012	-.0027	-.0035	.2086	.0100
.301	126.3	5.79	.3059	.0404	.0439	.0010	-.0035	-.0045	.3084	.0094
.300	125.9	7.81	.4191	.0656	.0612	.0005	-.0042	-.0052	.4241	.0081
.300	125.8	9.65	.5210	.0959	.0785	.0000	-.0050	-.0061	.5297	.0072
.301	126.1	11.69	.6335	.1380	.0995	-.0006	-.0058	-.0066	.6484	.0068
.299	125.2	13.74	.7493	.1900	.1204	-.0014	-.0069	-.0076	.7730	.0065
.300	125.8	15.71	.8507	.2468	.1398	-.0017	-.0078	-.0090	.8857	.0073
.301	126.6	17.75	.9515	.3119	.1496	-.0026	-.0083	-.0098	1.0013	.0070
.300	125.6	19.59	1.0643	.3846	.1630	-.0020	-.0091	-.0110	1.1316	.0055
.300	125.8	21.59	1.1860	.4737	.1848	-.0031	-.0099	-.0124	1.2771	.0040
.301	126.1	-.00	.0025	.0149	.0018	.0022	-.0018	-.0012	.0025	.0149

TEST 105 RUN 27

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.2	-.06	-.0994	.0425	-.0103	.0019	-.0010	.0015	-.0994	.0424
.301	126.0	-.96	-.1474	.0479	-.0186	.0023	-.0006	.0016	-.1482	.0454
.301	126.3	-.04	-.0977	.0408	-.0128	.0020	-.0007	.0024	-.0977	.0408
.301	126.4	1.91	.0034	.0336	.0016	.0011	-.0008	.0013	.0045	.0334
.301	126.0	3.82	.1035	.0314	.0195	.0010	-.0011	.0003	.1054	.0244
.301	126.5	5.74	.1956	.0364	.0411	.0007	-.0019	-.0002	.1983	.0166
.301	126.6	7.79	.3013	.0479	.0626	.0006	-.0027	-.0020	.3050	.0067
.301	126.3	9.64	.3880	.0636	.0795	.0005	-.0034	-.0019	.3932	-.0023
.299	125.1	11.64	.4785	.0873	.0998	-.0001	-.0042	-.0025	.4863	-.0110
.301	126.0	13.61	.5730	.1152	.1149	-.0002	-.0049	-.0033	.5840	-.0229
.300	125.9	15.59	.6640	.1480	.1286	-.0001	-.0059	-.0042	.6793	-.0359
.300	125.5	17.61	.7288	.1786	.1355	.0001	-.0072	-.0050	.7487	-.0502
.300	125.8	19.46	.8183	.2173	.1434	-.0001	-.0068	-.0057	.8439	-.0677
.300	125.2	21.45	.9198	.2723	.1612	-.0013	-.0069	-.0066	.9556	-.0829
.300	125.9	-.05	-.1065	.0463	-.0112	.0021	.0001	.0028	-.1065	.0462

TABLE IV.- Continued

TEST 105 RUN 31

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	125.2	.01	.0142	.0154	-.0003	.0018	-.0016	-.0002	.0142	.0154
.300	124.5	-.93	-.0262	.0151	-.0077	.0016	-.0014	.0002	-.0284	.0146
.301	125.9	-.00	.0180	.0137	-.0012	.0017	-.0016	.0003	.0180	.0137
.301	125.8	1.96	.1106	.0169	.0156	.0013	-.0022	-.0013	.1111	.0132
.301	125.7	3.89	.2136	.0257	.0355	.0012	-.0030	-.0023	.2149	.0112
.301	125.8	5.77	.3140	.0417	.0565	.0008	-.0037	-.0028	.3166	.0099
.300	125.0	7.82	.4338	.0675	.0771	.0004	-.0047	-.0039	.4389	.0078
.300	124.7	9.69	.5406	.0990	.0951	.0002	-.0054	-.0050	.5495	.0065
.300	125.1	11.71	.6527	.1408	.1182	-.0003	-.0063	-.0054	.6677	.0055
.300	124.8	13.80	.7689	.1936	.1436	-.0009	-.0073	-.0072	.7929	.0045
.300	125.1	15.75	.8833	.2525	.1634	-.0011	-.0084	-.0077	.9187	.0032
.300	124.9	17.74	.9969	.3210	.1840	-.0021	-.0088	-.0085	1.0473	.0019
.300	124.5	19.67	1.1012	.3944	.2124	-.0026	-.0097	-.0098	1.1697	.0008
.301	125.6	21.69	1.2135	.4818	.2424	-.0042	-.0107	-.0114	1.3056	-.0007
.300	125.2	.00	.0100	.0154	.0015	.0018	-.0014	-.0002	.0100	.0154

TEST 105 RUN 32

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	125.8	-.05	-.0904	.0516	-.0116	.0013	-.0010	.0005	-.0904	.0515
.300	124.9	-.99	-.1407	.0581	-.0229	.0014	-.0006	.0012	-.1417	.0557
.301	125.3	-.07	-.0936	.0510	-.0153	.0014	-.0008	.0004	-.0937	.0509
.300	125.2	1.93	.0112	.0418	.0045	.0011	-.0015	-.0000	.0126	.0414
.301	125.3	3.81	.1079	.0381	.0261	.0008	-.0021	-.0014	.1102	.0308
.301	125.5	5.77	.2106	.0420	.0494	.0004	-.0029	-.0026	.2138	.0206
.301	125.5	7.77	.3129	.0520	.0710	.0005	-.0039	-.0029	.3171	.0092
.300	124.9	9.69	.4132	.0682	.0883	.0003	-.0046	-.0035	.4188	-.0023
.301	125.3	11.67	.5067	.0916	.1076	-.0002	-.0053	-.0048	.5148	-.0128
.300	124.5	13.70	.6063	.1214	.1256	-.0004	-.0061	-.0058	.6178	-.0257
.301	125.4	15.63	.7029	.1541	.1440	-.0010	-.0066	-.0063	.7184	-.0409
.300	124.9	17.61	.7903	.1926	.1617	-.0015	-.0072	-.0075	.8115	-.0556
.300	125.0	19.51	.8790	.2371	.1819	-.0021	-.0078	-.0080	.9077	-.0701
.301	125.6	21.53	.9740	.2928	.2040	-.0031	-.0081	-.0091	1.0135	-.0851
.301	125.3	-.05	-.0894	.0515	-.0141	.0013	-.0007	.0007	-.0894	.0514

TEST 105 RUN 36

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	125.9	.01	.0091	.0089	-.0015	.0003	-.0005	-.0001	.0091	.0089
.300	125.4	-.91	-.0098	.0084	-.0007	.0003	-.0005	-.0000	-.0099	.0083
.301	125.8	-.00	.0097	.0085	-.0015	.0004	-.0005	.0002	.0097	.0085
.300	125.2	1.95	.0623	.0101	-.0050	.0005	-.0003	-.0004	.0626	.0080
.301	125.7	3.86	.1163	.0155	-.0079	.0004	-.0003	-.0009	.1171	.0077
.300	125.5	5.76	.1762	.0249	-.0112	.0005	-.0003	-.0014	.1778	.0071
.300	125.4	7.76	.2468	.0400	-.0148	.0006	-.0005	-.0019	.2500	.0063
.300	125.1	9.66	.3158	.0591	-.0183	.0007	-.0010	-.0022	.3212	.0053
.300	125.2	11.71	.3952	.0860	-.0220	.0008	-.0017	-.0031	.4044	.0040
.301	125.8	13.70	.4754	.1186	-.0261	.0005	-.0025	-.0037	.4899	.0027
.300	125.2	15.71	.5532	.1564	-.0292	.0006	-.0036	-.0043	.5748	.0007
.301	126.0	17.72	.5930	.1890	-.0263	.0004	-.0043	-.0048	.6224	-.0004
.300	125.3	19.63	.6333	.2296	-.0236	-.0007	-.0041	-.0051	.6736	.0035
.301	125.6	21.67	.6762	.2770	-.0201	-.0015	-.0042	-.0054	.7307	.0077
.300	125.4	3.85	.1233	.0171	-.0091	-.0001	-.0010	-.0010	.1242	.0088
.300	125.4	.00	.0130	.0093	-.0023	.0002	-.0007	.0002	.0130	.0093

TEST 105 RUN 39

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.4	-.03	-.0371	.0137	.0002	.0002	-.0009	.0006	-.0371	.0136
.301	126.5	-.93	-.0609	.0161	.0018	.0001	-.0009	.0010	-.0612	.0151
.302	127.3	-.01	-.0397	.0136	.0009	.0004	-.0009	.0010	-.0397	.0135
.300	125.9	1.93	.0132	.0106	-.0018	.0002	-.0007	.0006	.0136	.0102
.301	126.2	3.82	.0654	.0104	-.0050	.0003	-.0004	.0002	.0659	.0060
.301	126.4	5.73	.1102	.0137	-.0076	.0002	-.0004	-.0000	.1110	.0026
.301	126.2	7.71	.1595	.0201	-.0109	.0001	-.0003	-.0003	.1608	-.0015
.300	126.0	9.60	.2069	.0276	-.0134	.0004	-.0004	-.0003	.2106	-.0076
.300	125.7	11.63	.2629	.0381	-.0157	.0001	-.0005	-.0009	.2652	-.0157
.301	126.6	13.60	.3180	.0514	-.0188	.0001	-.0009	-.0017	.3211	-.0248
.301	126.2	15.58	.3814	.0709	-.0237	-.0000	-.0015	-.0017	.3864	-.0342
.300	125.8	17.58	.4504	.0957	-.0299	.0001	-.0024	-.0026	.4582	-.0448
.300	126.0	19.49	.5033	.1223	-.0324	-.0005	-.0027	-.0029	.5152	-.0527
.301	126.3	21.47	.5297	.1451	-.0310	-.0012	-.0028	-.0030	.5461	-.0589
.300	126.1	-.02	-.0330	.0155	.0005	.0002	-.0010	.0012	-.0330	.0155

TABLE IV.- Continued

TEST 105 RUN 40

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	126.5	-.01	.1163	.0247	-.0524	.0004	-.0002	-.0006	.1163	.0247
.300	126.3	-.88	.0963	.0245	-.0518	.0003	-.0000	-.0004	.0959	.0259
.301	126.6	.02	.1157	.0246	-.0523	.0003	-.0001	-.0003	.1157	.0246
.300	126.3	1.99	.1655	.0267	-.0545	.0005	-.0004	-.0008	.1663	.0210
.301	127.0	3.88	.1935	.0305	-.0548	.0003	-.0008	-.0006	.1951	.0173
.302	127.4	5.73	.2085	.0339	-.0540	.0002	-.0011	-.0009	.2108	.0129
.300	126.4	7.69	.2323	.0393	-.0535	.0000	-.0014	-.0011	.2355	.0079
.300	126.5	9.57	.2550	.0454	-.0522	-.0000	-.0019	-.0017	.2590	.0024
.300	126.2	11.55	.2794	.0568	-.0510	.0001	-.0023	-.0016	.2851	-.0003
.300	126.4	13.50	.2998	.0688	-.0495	.0001	-.0026	-.0017	.3075	-.0031
.300	125.8	15.47	.3241	.0831	-.0483	.0003	-.0031	-.0018	.3345	-.0063
.300	126.4	17.42	.3441	.0981	-.0466	.0005	-.0034	-.0021	.3577	-.0095
.301	126.8	19.34	.3726	.1169	-.0442	-.0005	-.0036	-.0022	.3903	-.0131
.301	127.0	21.30	.3944	.1356	-.0427	-.0007	-.0035	-.0024	.4168	-.0169
.300	126.4	-.01	.1195	.0256	-.0529	.0001	-.0004	-.0002	.1195	.0256

TEST 105 RUN 41

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.299	124.2	-.03	-.0249	.0119	-.0003	.0000	-.0008	.0006	-.0249	.0119
.300	124.6	-.98	-.0498	.0139	.0004	-.0001	-.0010	.0008	-.0500	.0130
.300	124.9	-.02	-.0241	.0115	-.0001	-.0000	-.0009	.0006	-.0241	.0115
.300	124.6	1.99	.0291	.0100	-.0029	.0000	-.0007	.0003	.0294	.0090
.301	125.3	3.93	.0792	.0119	-.0058	.0000	-.0005	.0002	.0799	.0064
.302	125.9	5.74	.1219	.0154	-.0085	.0000	-.0004	-.0002	.1228	.0032
.301	125.2	7.72	.1762	.0228	-.0114	-.0002	-.0003	-.0006	.1777	-.0010
.301	125.2	9.59	.2263	.0317	-.0137	-.0001	-.0004	-.0009	.2284	-.0065
.301	125.2	11.63	.2895	.0459	-.0175	-.0004	-.0005	-.0014	.2928	-.0134
.300	124.3	13.61	.3583	.0653	-.0224	.0001	-.0010	-.0018	.3636	-.0209
.301	125.1	15.61	.4309	.0912	-.0277	-.0001	-.0017	-.0025	.4395	-.0281
.301	125.0	17.61	.5046	.1240	-.0317	-.0003	-.0022	-.0029	.5185	-.0344
.300	124.8	19.52	.5468	.1520	-.0311	-.0009	-.0026	-.0033	.5661	-.0394
.301	125.4	21.49	.5657	.1861	-.0281	-.0020	-.0026	-.0037	.6132	-.0414
.300	124.5	-.05	-.0223	.0142	-.0005	-.0001	-.0007	.0012	-.0223	.0142

TEST 105 RUN 42

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.300	124.1	-.05	-.0841	.0377	-.0120	.0016	-.0019	.0012	-.0841	.0377
.300	124.2	-.98	-.1263	.0462	-.0142	.0013	-.0010	.0020	-.1271	.0440
.300	124.4	-.08	-.0813	.0390	-.0120	.0015	-.0009	.0022	-.0814	.0389
.301	124.6	1.90	.0155	.0309	-.0081	.0014	-.0010	.0017	.0166	.0304
.301	125.0	3.79	.1016	.0272	-.0044	.0012	-.0010	.0006	.1032	.0204
.300	124.5	5.69	.1879	.0279	-.0021	.0013	-.0007	.0001	.1897	.0092
.300	124.6	7.78	.2727	.0353	-.0004	.0012	-.0008	-.0013	.2749	-.0019
.300	124.5	9.53	.3450	.0436	.0029	.0012	-.0009	-.0013	.3475	-.0141
.300	123.9	11.55	.4323	.0577	.0061	.0014	-.0013	-.0021	.4351	-.0300
.300	124.5	13.51	.5180	.0773	.0117	.0013	-.0016	-.0028	.5217	-.0459
.300	124.4	15.50	.6006	.1058	.0170	.0007	-.0019	-.0041	.6070	-.0586
.299	123.8	17.46	.6938	.1395	.0233	.0001	-.0019	-.0043	.7037	-.0752
.300	124.3	19.38	.7755	.1835	.0298	.0005	-.0028	-.0054	.7925	-.0843
.299	123.7	21.30	.8307	.2344	.0382	.0001	-.0025	-.0058	.8591	-.0834
.300	124.2	-.07	-.0772	.0426	-.0125	.0010	-.0000	.0019	-.0773	.0425

TEST 105 RUN 43

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	124.8	-.07	-.1117	.0482	-.0151	.0018	-.0018	.0024	-.1118	.0480
.301	125.0	-.94	-.1469	.0547	-.0171	.0015	-.0015	.0020	-.1478	.0523
.301	125.2	-.05	-.1060	.0479	-.0144	.0014	-.0014	.0023	-.1061	.0478
.301	125.2	2.02	-.0136	.0366	-.0098	.0015	-.0013	.0016	-.0123	.0371
.301	125.2	3.82	.0678	.0307	-.0069	.0015	-.0013	.0009	.0697	.0262
.301	125.3	5.71	.1527	.0289	-.0036	.0013	-.0012	.0009	.1548	.0136
.300	124.5	7.70	.2444	.0322	-.0003	.0015	-.0013	-.0006	.2465	-.0009
.300	124.2	9.57	.3233	.0392	.0009	.0017	-.0016	-.0005	.3253	-.0151
.300	124.3	11.58	.4028	.0509	.0038	.0014	-.0018	-.0018	.4048	-.0310
.300	124.2	13.54	.4819	.0657	.0074	.0014	-.0022	-.0025	.4839	-.0489
.300	124.4	15.52	.5642	.0847	.0122	.0015	-.0028	-.0032	.5663	-.0694
.300	124.4	17.47	.6451	.1097	.0182	.0011	-.0029	-.0039	.6482	-.0891
.299	123.9	19.39	.7232	.1434	.0225	.0005	-.0030	-.0053	.7298	-.1048
.300	124.4	21.44	.8107	.1869	.0279	-.0005	-.0024	-.0054	.8229	-.1224
.301	125.0	-.05	-.1029	.0529	-.0060	-.0004	.0536	.0015	-.1030	.0528

TABLE IV.- Concluded

TEST 105 RUN 44

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.3	-.03	-.0565	.0289	.0012	.0014	-.0020	.0012	-.0565	.0289
.300	125.9	-.94	-.1034	.0323	.0018	.0018	-.0018	.0012	-.1039	.0306
.301	126.4	-.03	-.0625	.0280	.0030	.0016	-.0018	.0008	-.0625	.0280
.300	126.1	1.93	.0203	.0222	.0027	.0017	-.0019	-.0004	.0210	.0215
.301	126.3	3.82	.1098	.0193	.0009	.0017	-.0020	-.0004	.1109	.0119
.302	127.0	5.72	.1947	.0226	-.0005	.0012	-.0021	-.0008	.1960	.0031
.301	126.5	7.71	.2784	.0287	-.0012	.0014	-.0023	-.0007	.2798	-.0089
.301	126.2	9.57	.3516	.0389	-.0019	.0015	-.0026	-.0018	.3532	-.0201
.300	126.0	11.60	.4382	.0532	-.0025	.0021	-.0028	-.0020	.4399	-.0359
.300	126.1	13.55	.5144	.0709	-.0033	.0016	-.0037	-.0040	.5167	-.0516
.300	125.5	15.53	.5966	.0992	-.0012	.0013	-.0041	-.0039	.6013	-.0642
.300	126.0	17.50	.6788	.1354	-.0007	.0020	-.0045	-.0044	.6882	-.0749
.299	125.2	19.40	.7561	.1773	-.0005	.0015	-.0054	-.0052	.7721	-.0839
.300	125.5	21.39	.8276	.2335	-.0015	.0000	-.0049	-.0062	.8557	-.0845
.304	128.6	-.03	-.0531	.0313	.0020	.0018	-.0012	.0016	-.0531	.0313

TEST 105 RUN 45

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	127.1	-.03	-.0665	.0355	.0024	.0004	-.0025	.0007	-.0665	.0354
.300	126.3	-.97	-.1128	.0403	.0045	.0003	-.0026	.0014	-.1134	.0384
.301	126.6	-.05	-.0702	.0348	.0049	.0001	-.0026	.0011	-.0703	.0347
.301	126.8	1.92	.0188	.0289	.0032	.0006	-.0024	.0002	.0197	.0282
.301	126.9	3.80	.1021	.0262	.0008	.0001	-.0022	-.0005	.1036	.0194
.300	126.4	5.71	.1940	.0263	-.0019	.0000	-.0022	-.0008	.1956	.0068
.301	126.9	7.68	.2761	.0323	-.0036	-.0003	-.0020	-.0019	.2779	-.0049
.300	126.4	9.58	.3531	.0419	-.0043	-.0003	-.0021	-.0024	.3551	-.0175
.301	126.6	11.58	.4281	.0538	-.0065	.0001	-.0025	-.0024	.4302	-.0333
.300	125.9	13.52	.5085	.0698	-.0081	.0006	-.0026	-.0032	.5108	-.0510
.300	126.2	15.53	.5916	.0996	-.0093	.0003	-.0031	-.0045	.5967	-.0624
.299	125.6	17.48	.6721	.1325	-.0098	.0008	-.0042	-.0056	.6809	-.0754
.299	125.4	19.38	.7380	.1666	-.0068	.0008	-.0041	-.0060	.7514	-.0877
.299	125.6	21.40	.8218	.2198	-.0049	-.0007	-.0030	-.0063	.8454	-.0952
.301	126.7	-.06	-.0697	.0395	.0033	.0006	-.0021	.0012	-.0698	.0394

TEST 105 RUN 46

MACH NUMB	Q PSF	α DEG	CL	CD	CMS	CRMS	CYMS	CYS	CN	CA
.301	126.0	-.03	-.0603	.0301	-.0021	.0013	-.0023	.0010	-.0603	.0300
.299	125.1	-.92	-.0961	.0331	-.0020	.0012	-.0020	.0018	-.0966	.0316
.301	125.9	-.01	-.0580	.0282	-.0010	.0012	-.0021	.0014	-.0580	.0282
.301	126.0	1.94	.0230	.0238	.0002	.0011	-.0022	.0010	.0238	.0230
.301	126.5	3.83	.1016	.0211	.0011	.0009	-.0022	.0004	.1028	.0143
.301	126.3	5.78	.1864	.0239	.0006	.0005	-.0021	-.0003	.1879	.0050
.299	125.0	7.74	.2667	.0301	.0009	.0010	-.0022	-.0008	.2683	-.0060
.300	125.6	9.58	.3320	.0401	.0020	.0010	-.0023	-.0012	.3340	-.0157
.300	125.4	11.59	.4057	.0535	.0041	.0006	-.0028	-.0020	.4082	-.0291
.300	125.6	13.52	.4780	.0704	.0052	.0008	-.0030	-.0023	.4812	-.0433
.301	126.3	15.48	.5622	.0961	.0041	.0012	-.0034	-.0036	.5674	-.0574
.300	125.5	17.46	.6401	.1291	.0049	.0006	-.0041	-.0039	.6494	-.0690
.300	125.6	19.39	.7087	.1628	.0075	.0015	-.0048	-.0047	.7226	-.0817
.300	125.8	21.30	.7697	.2099	.0097	-.0024	-.0024	-.0051	.7934	-.0840
.301	126.1	-.00	-.0500	.0336	-.0007	.0012	-.0009	.0032	-.0500	.0336

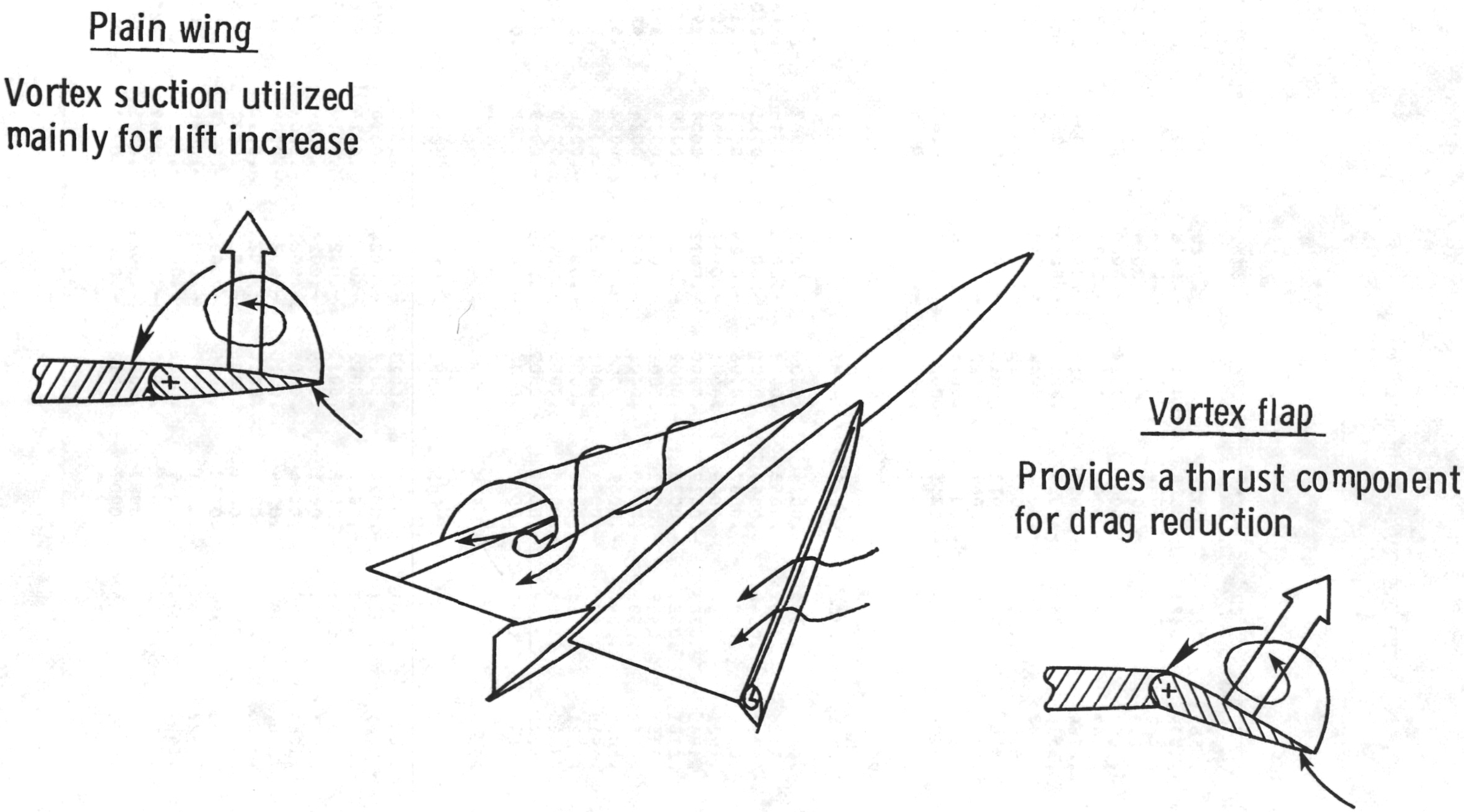


Figure 1.- Leading-edge vortex flap concept. Composite sketch compares vortex flow fields for undeflected (left) and deflected (right) vortex flap.

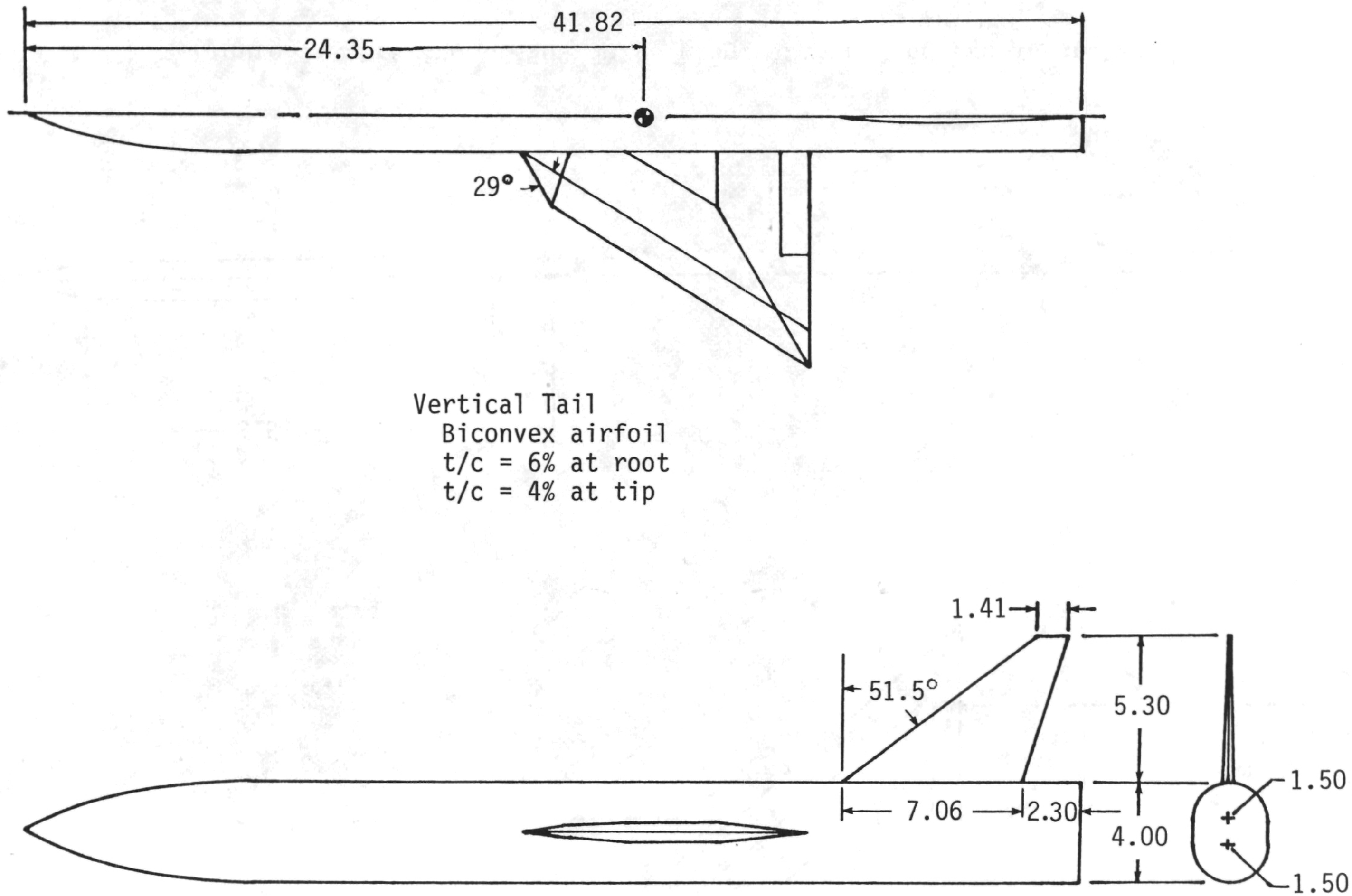


Figure 2.- Drawing of general research fighter fuselage with typical delta wing. Dimensions are in inches.

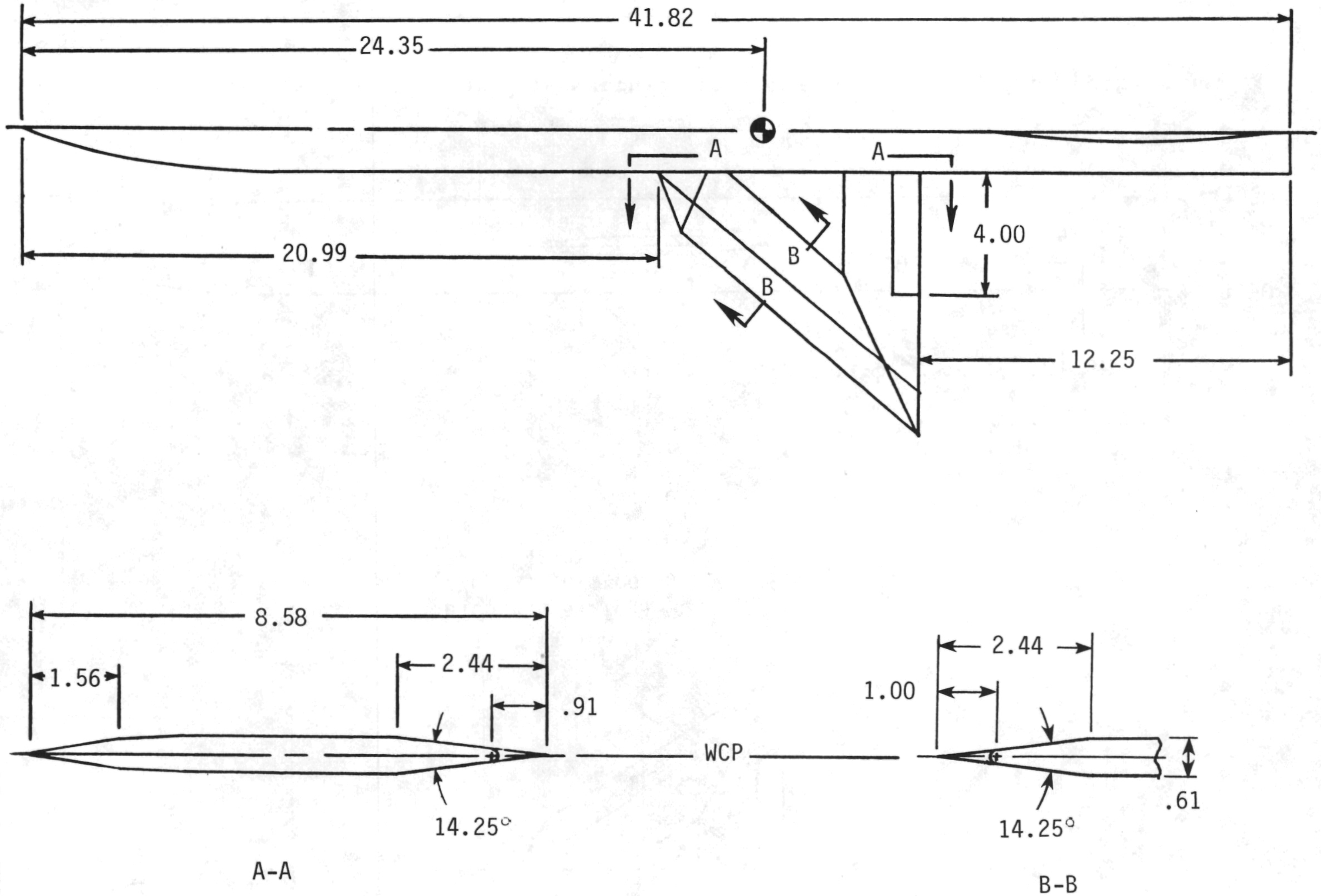
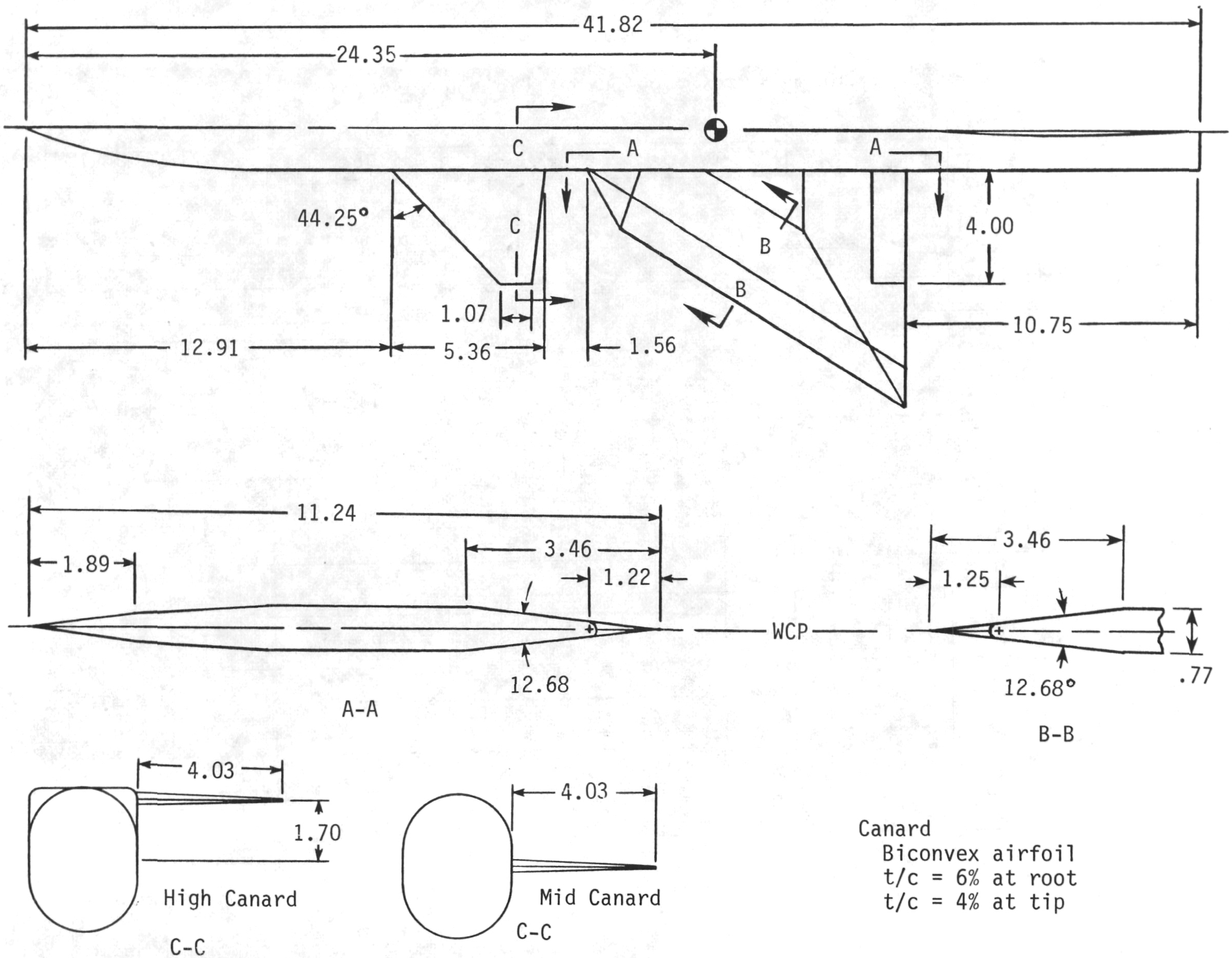
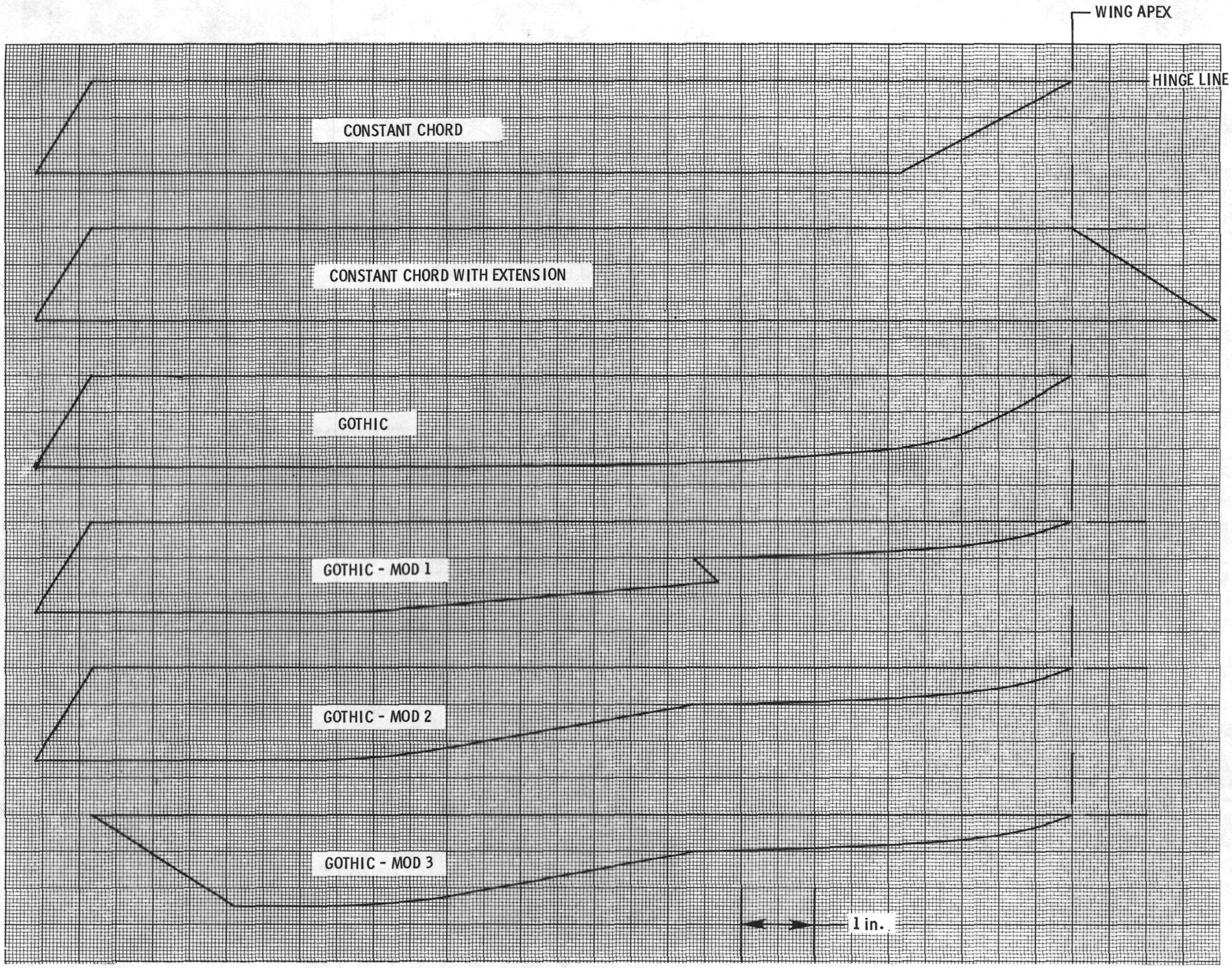


Figure 3.- Drawing of 50° delta wing. Dimensions are in inches.



(a) Canard configuration.

Figure 4.- Drawing of 58° delta wing. Dimensions are in inches.



(b) Sketches of leading-edge vortex flaps.

Figure 4.- Concluded.

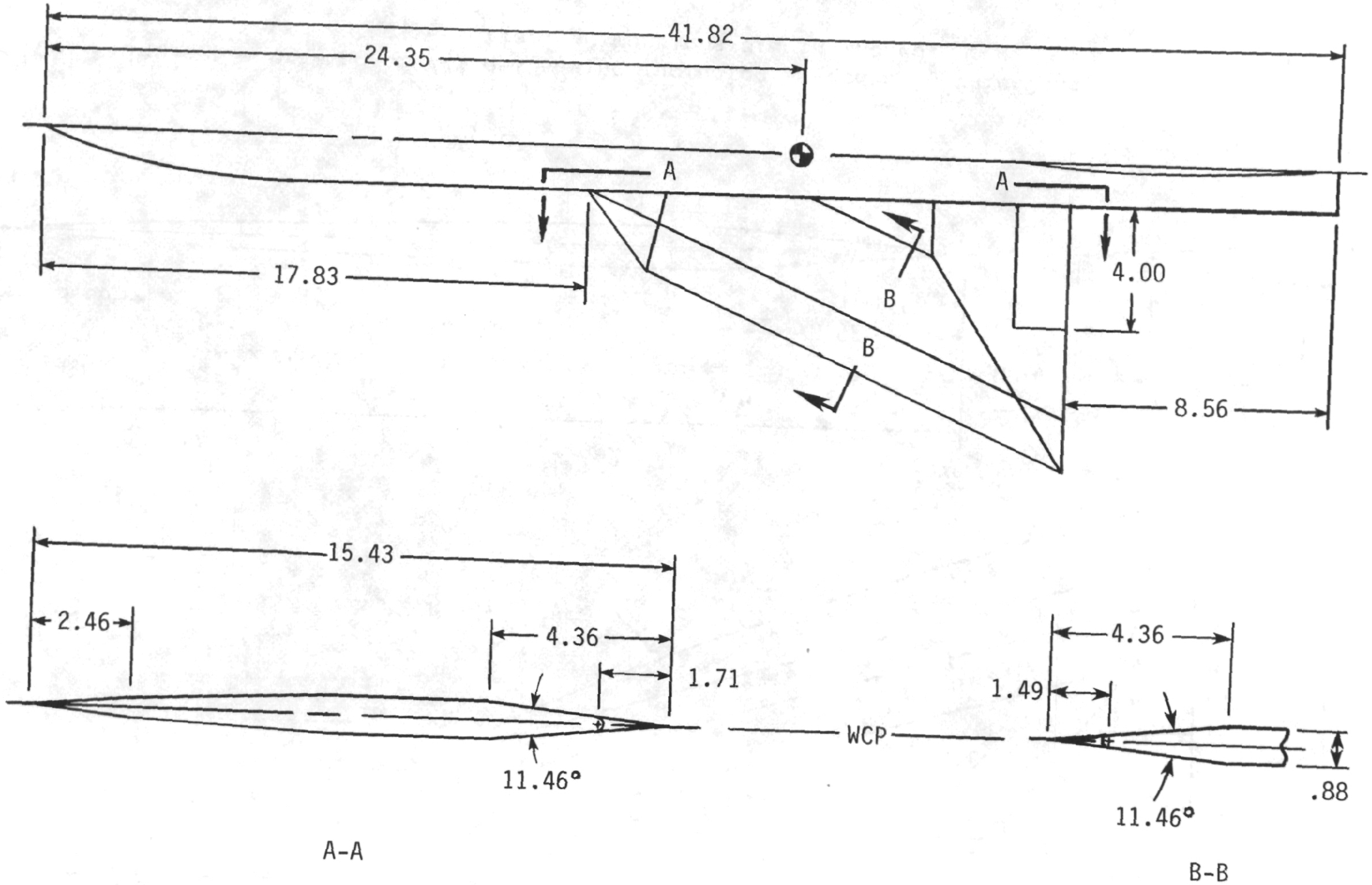


Figure 5.- Drawing of 66° delta wing. Dimensions are in inches.

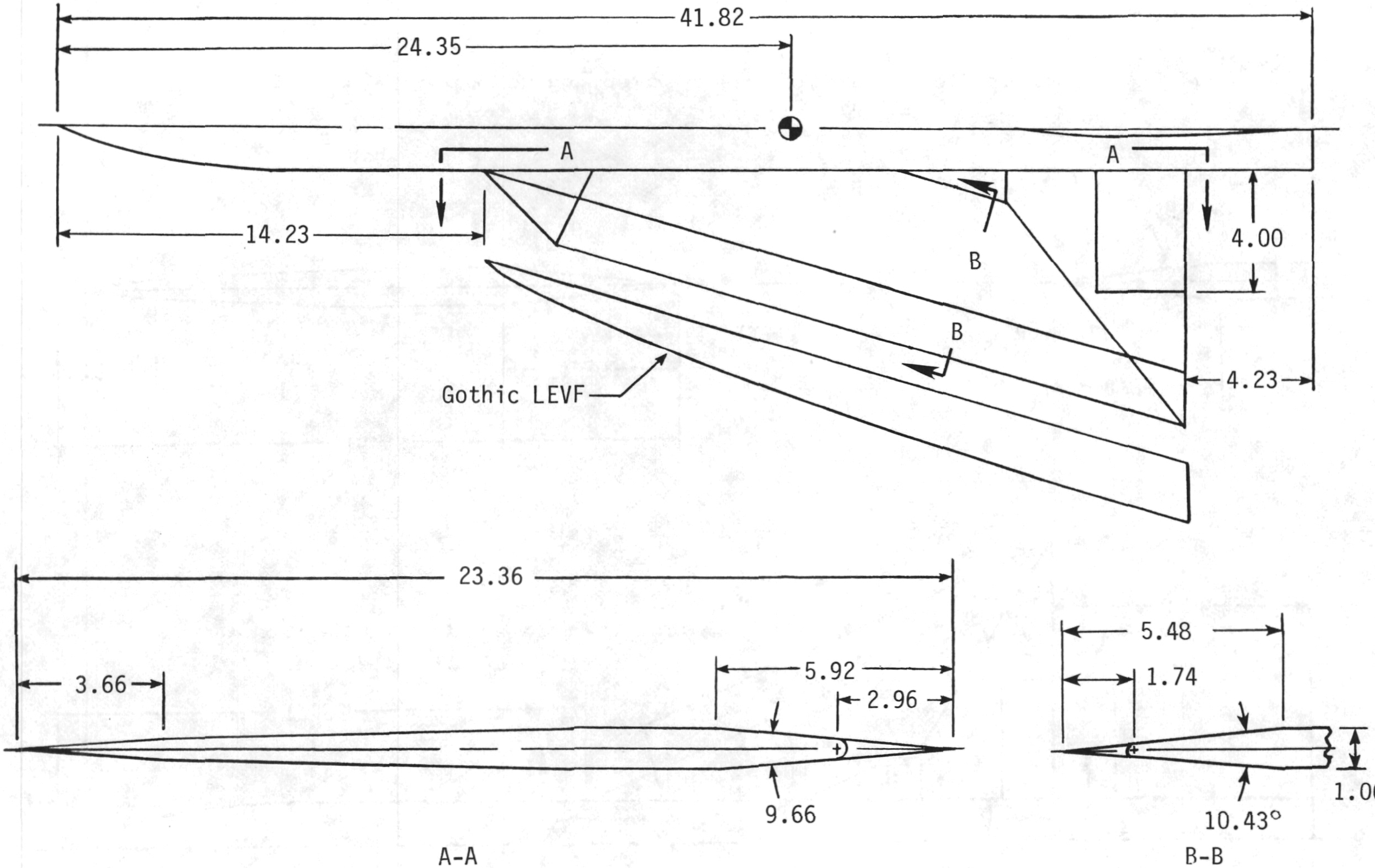
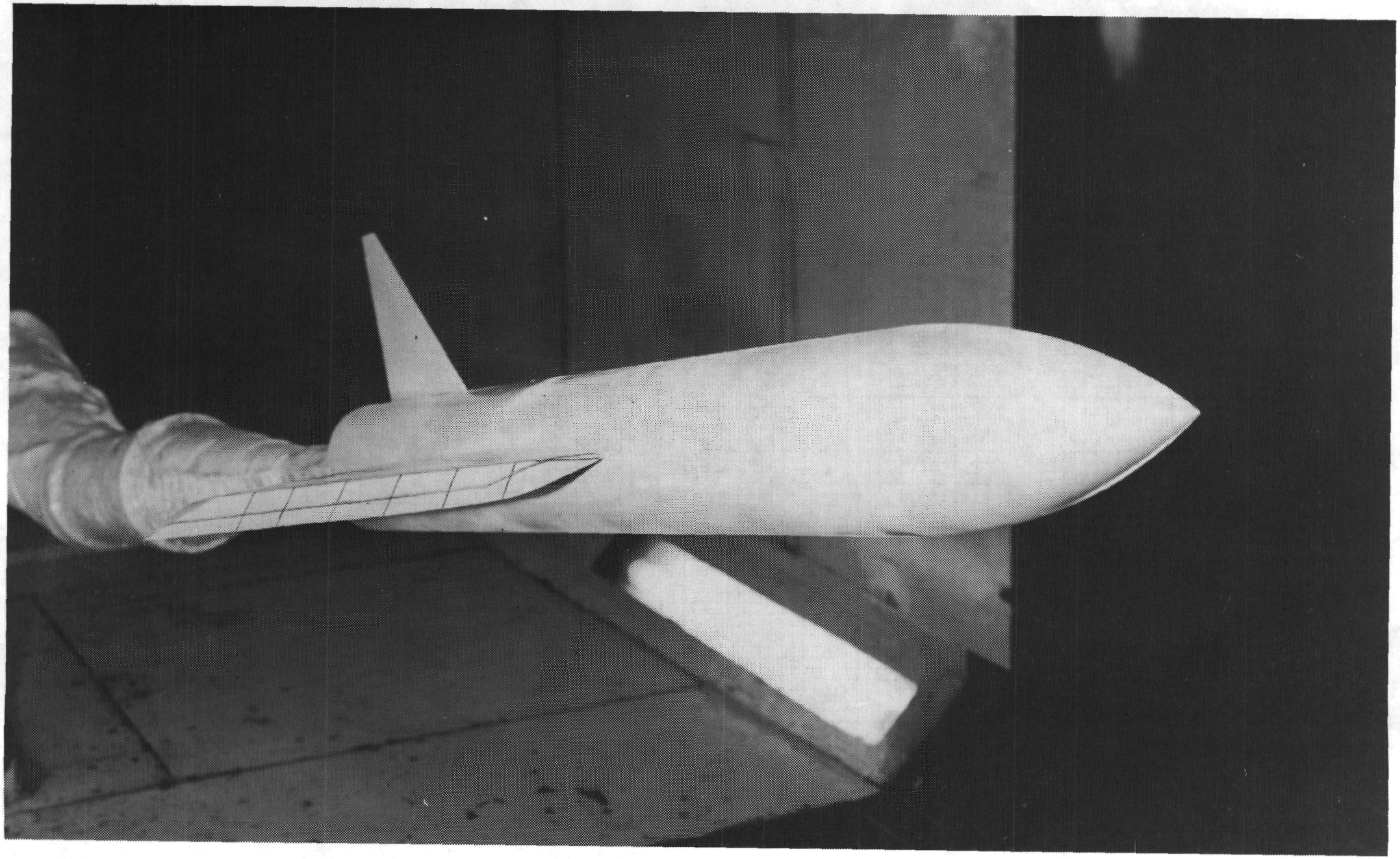
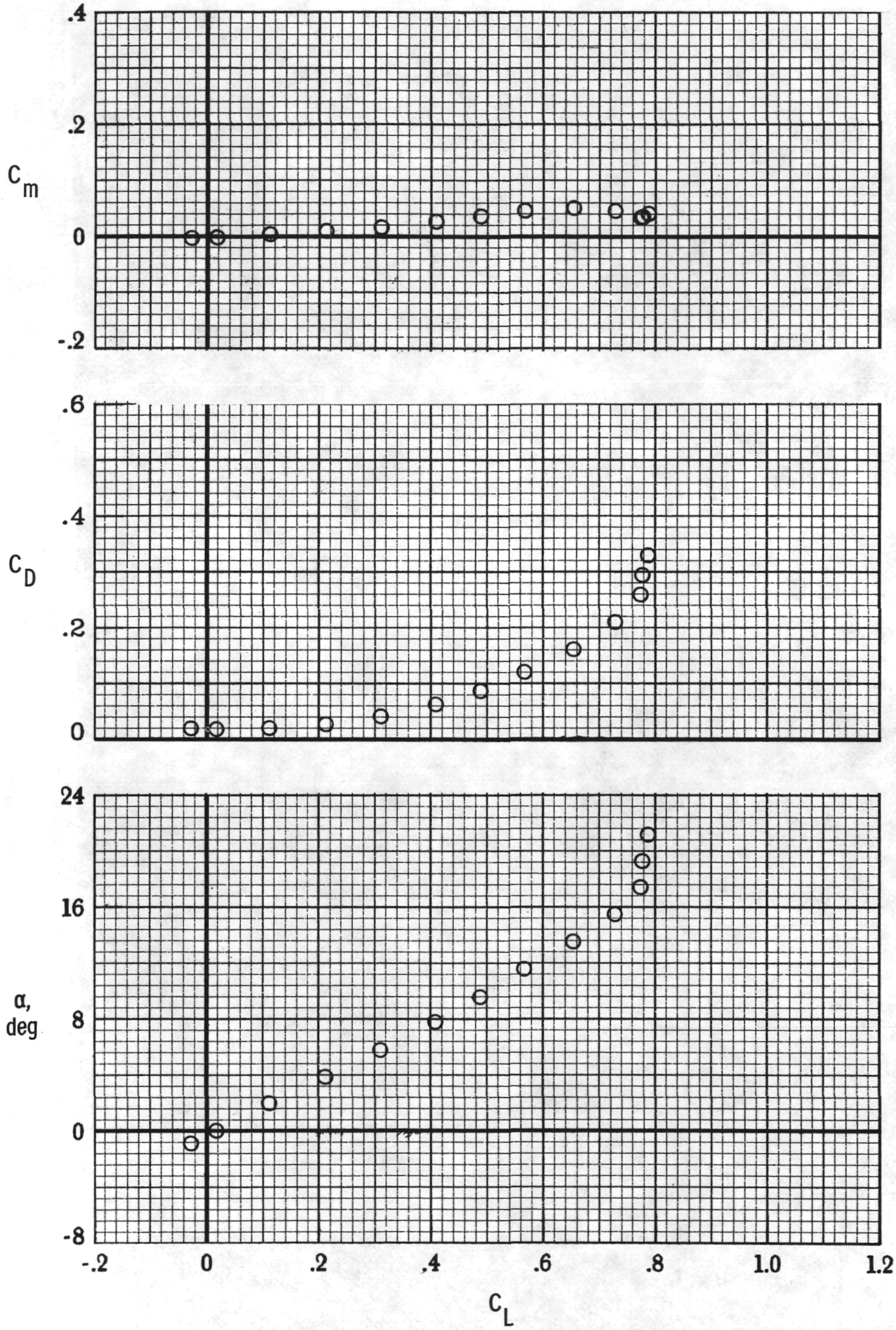


Figure 6.- Drawing of 74° delta wing including sketch of gothic leading-edge vortex flap. Dimensions are in inches.



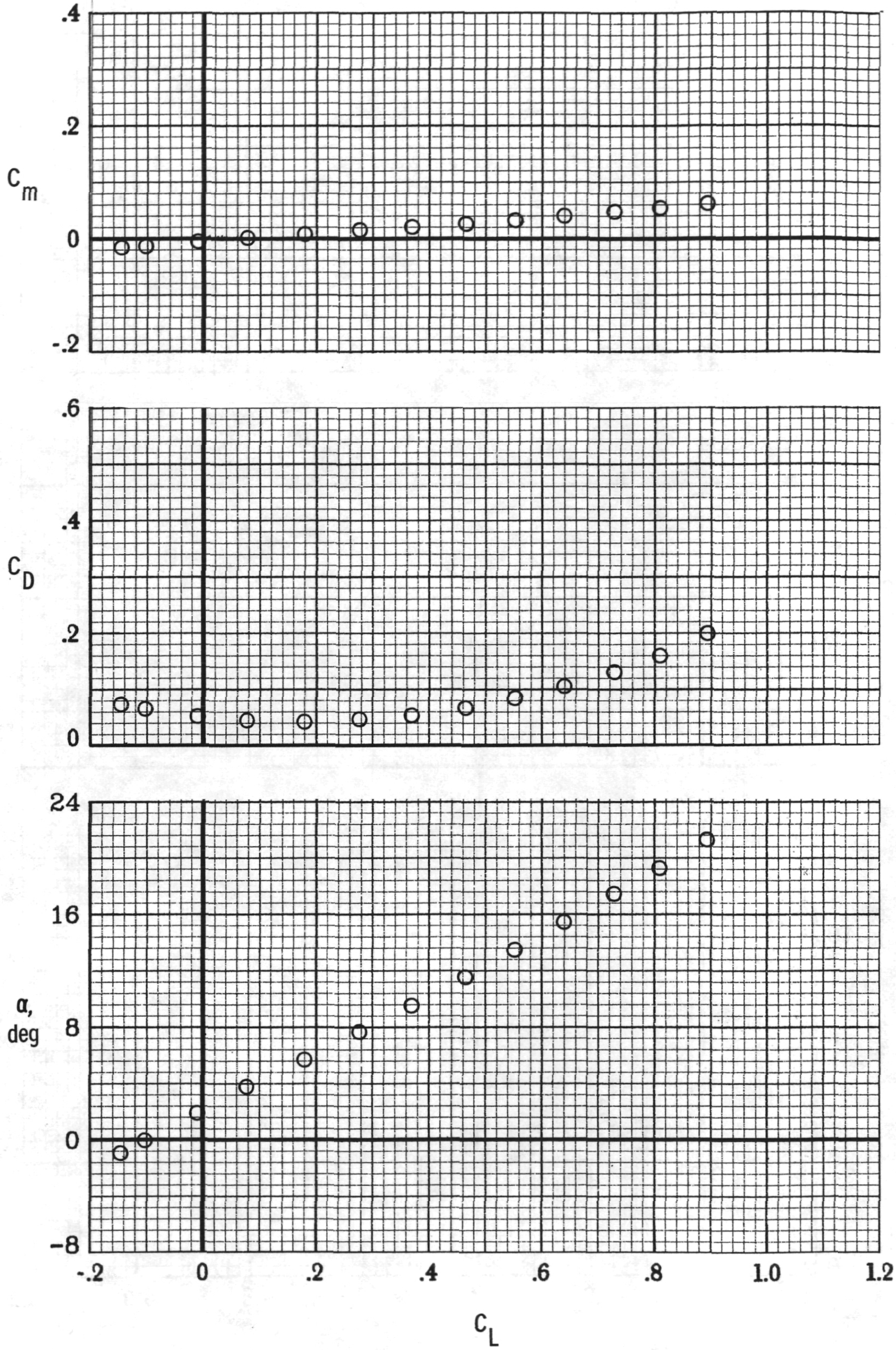
L-82-5956

Figure 7.- Photograph of 58° delta wing model with gothic leading-edge vortex flap.



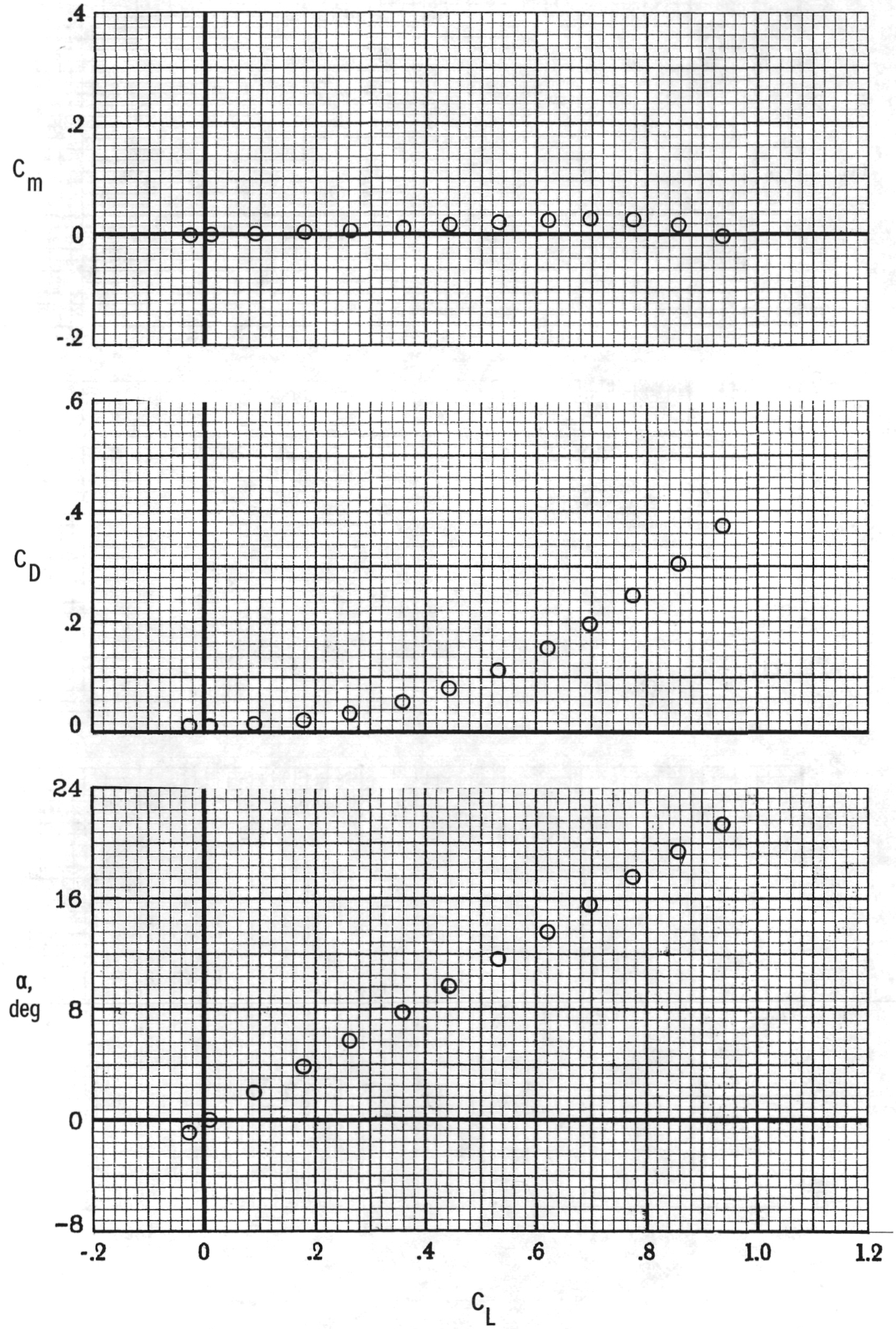
(a) $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 1.

Figure 8.- Static longitudinal data for 50° delta wing with constant-chord LEVF.



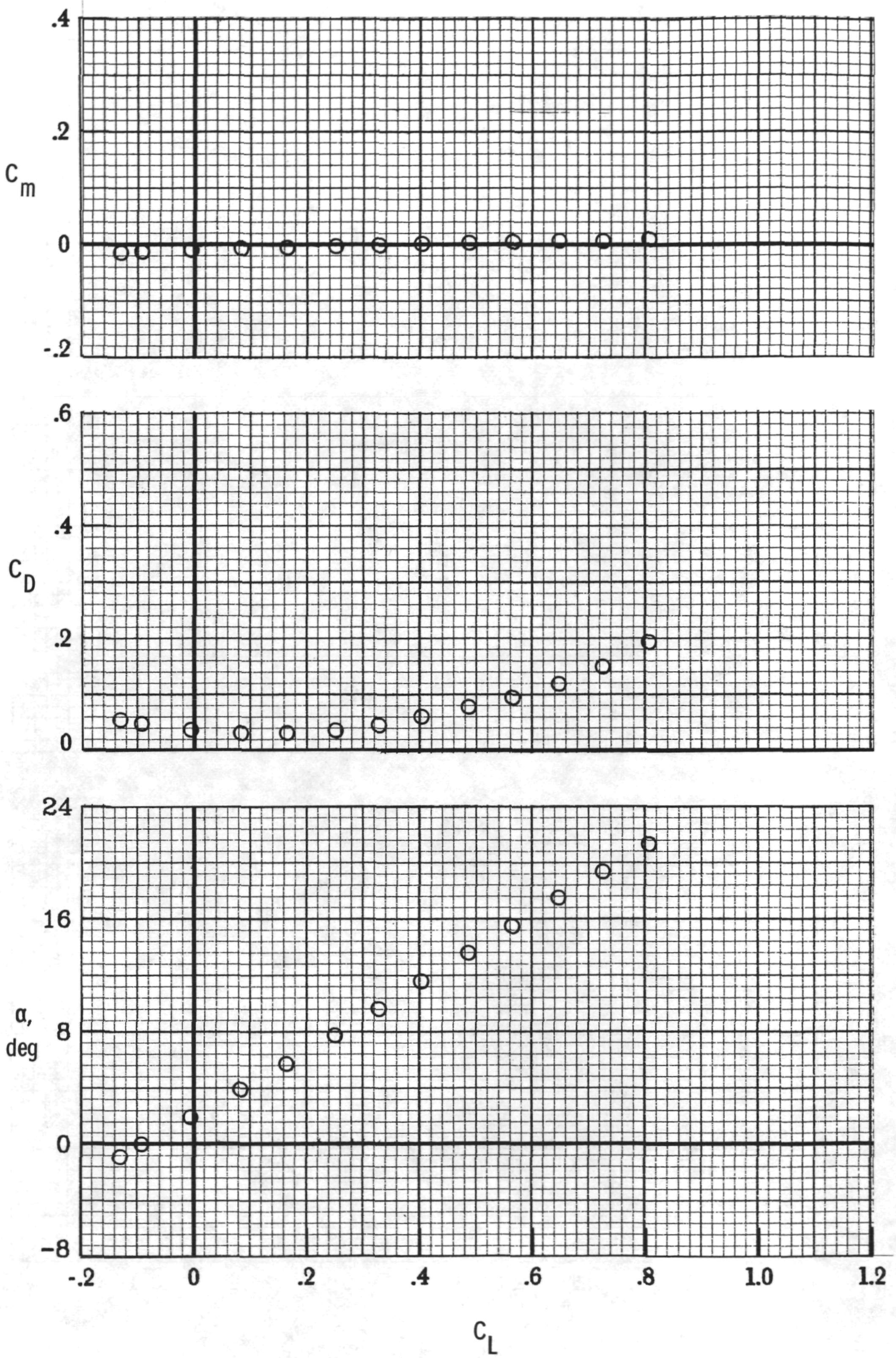
(b) δ_{LE} = 40°; δ_{TE} = 0°; run 4.

Figure 8.- Concluded.



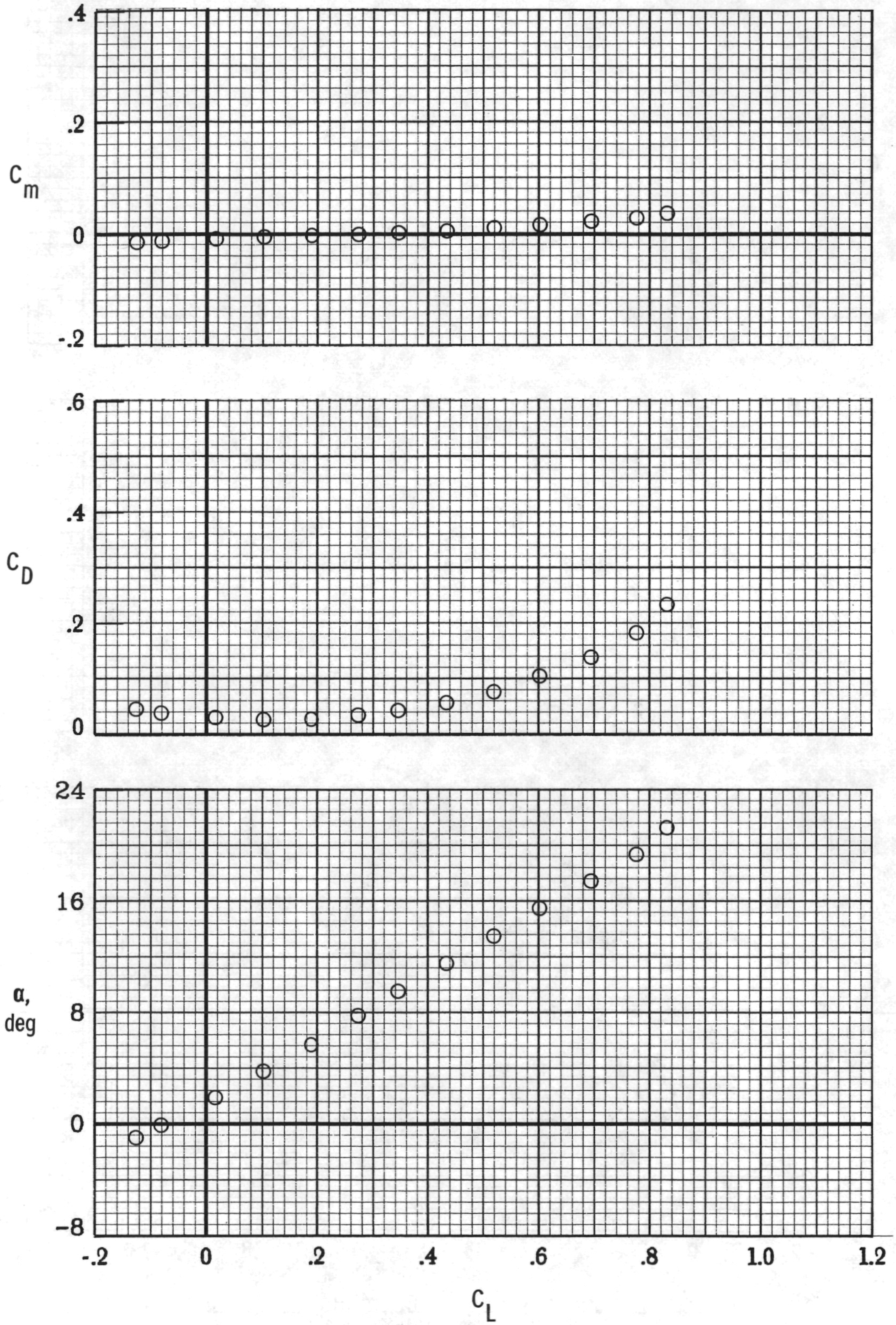
(a) Constant chord; $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 11.

Figure 9.- Static longitudinal data for 58° delta wing with LEVF.



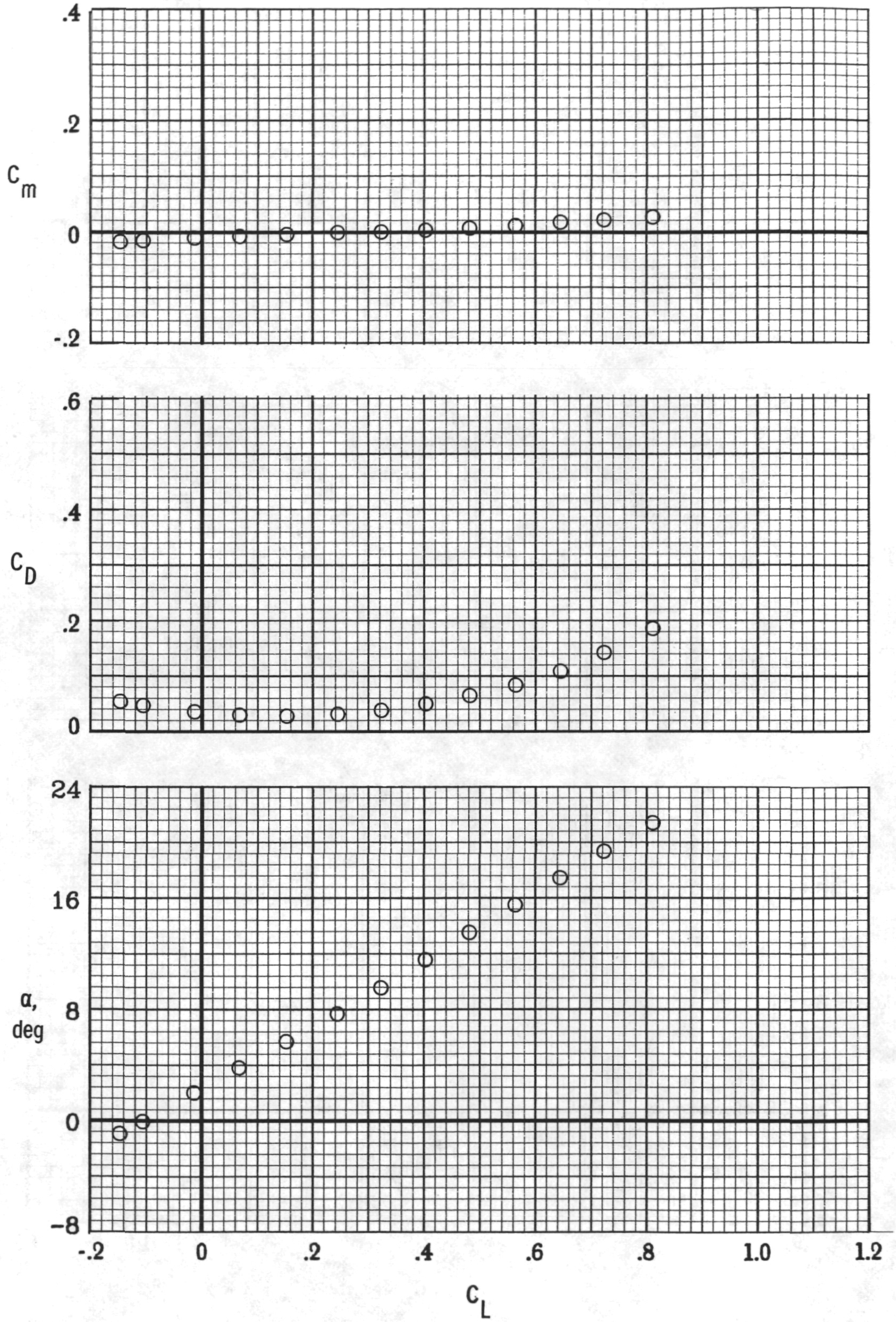
(b) Constant chord; δ_{LE} = 40°; δ_{TE} = 0°; run 14.

Figure 9.- Continued.



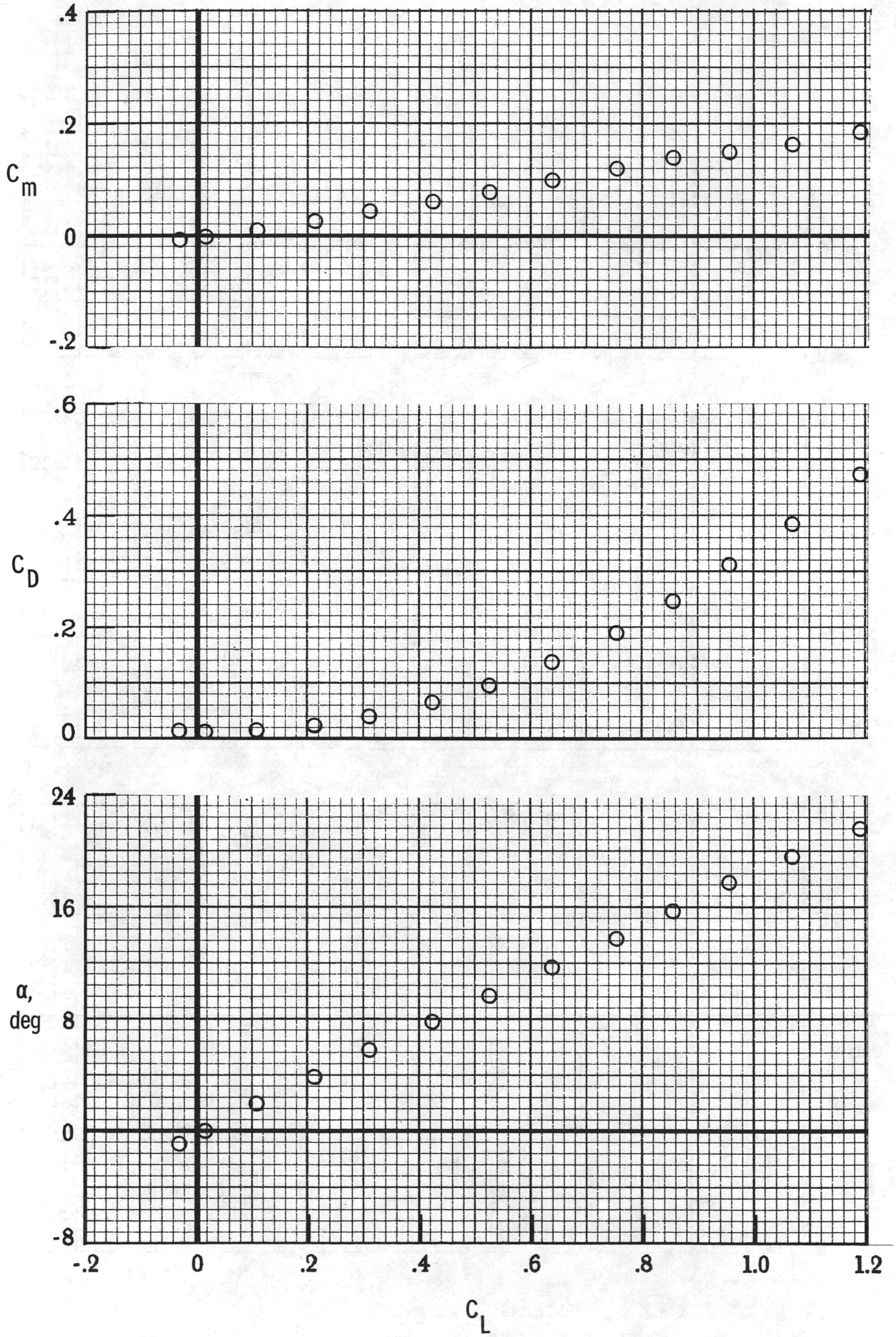
(c) Constant chord with extension; $\delta_{LE} = 30°$; $\delta_{TE} = 0°$; run 42.

Figure 9.- Continued.



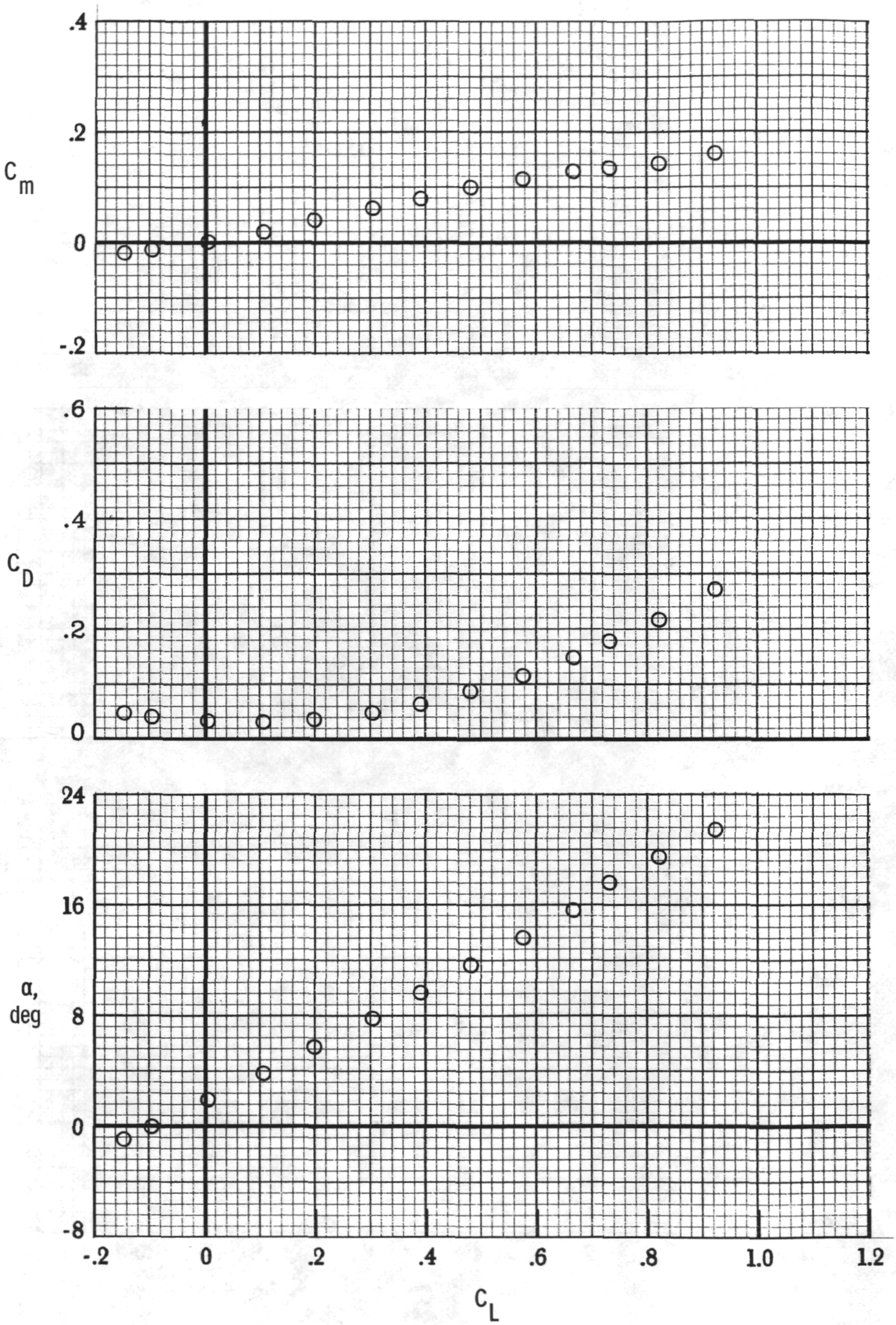
(d) Constant chord with extension; δ_{LE} = 40°; δ_{TE} = 0°; run 43.

Figure 9.- Continued.



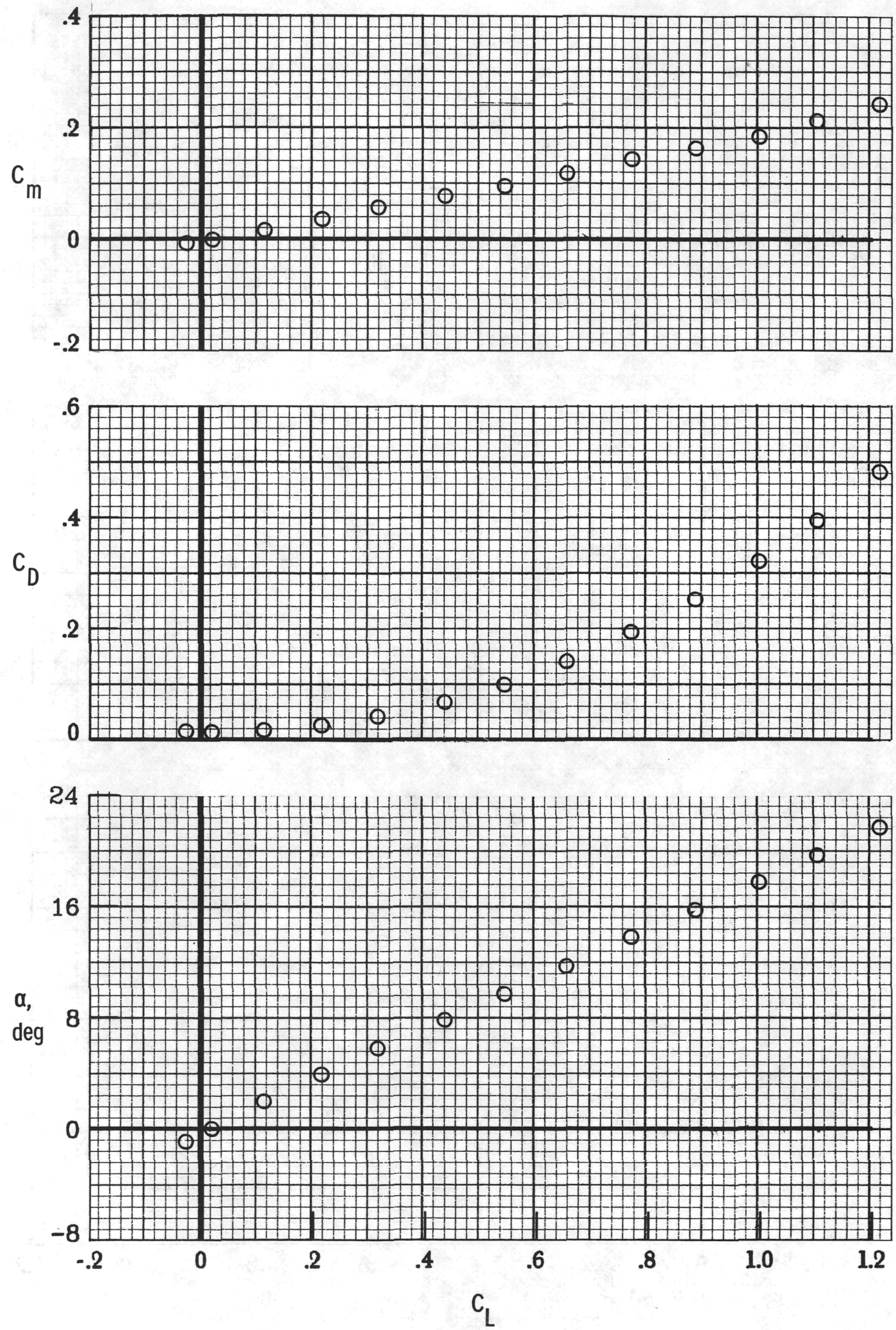
(e) Constant chord; mid canard; $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 26.

Figure 9.- Continued.



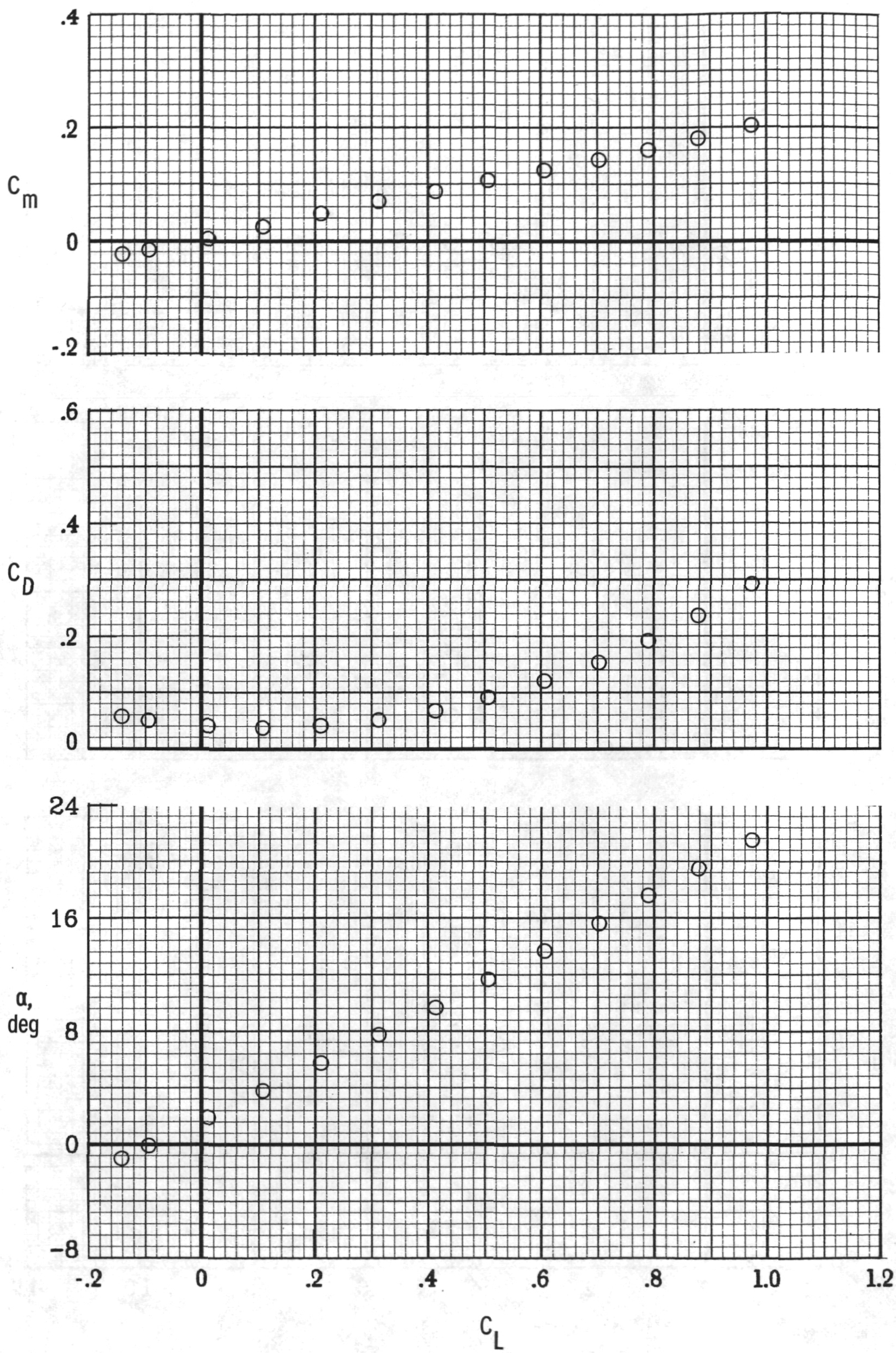
(f) Constant chord; mid canard; $\delta_{LE} = 40°$; $\delta_{TE} = 0°$; run 27.

Figure 9.- Continued.



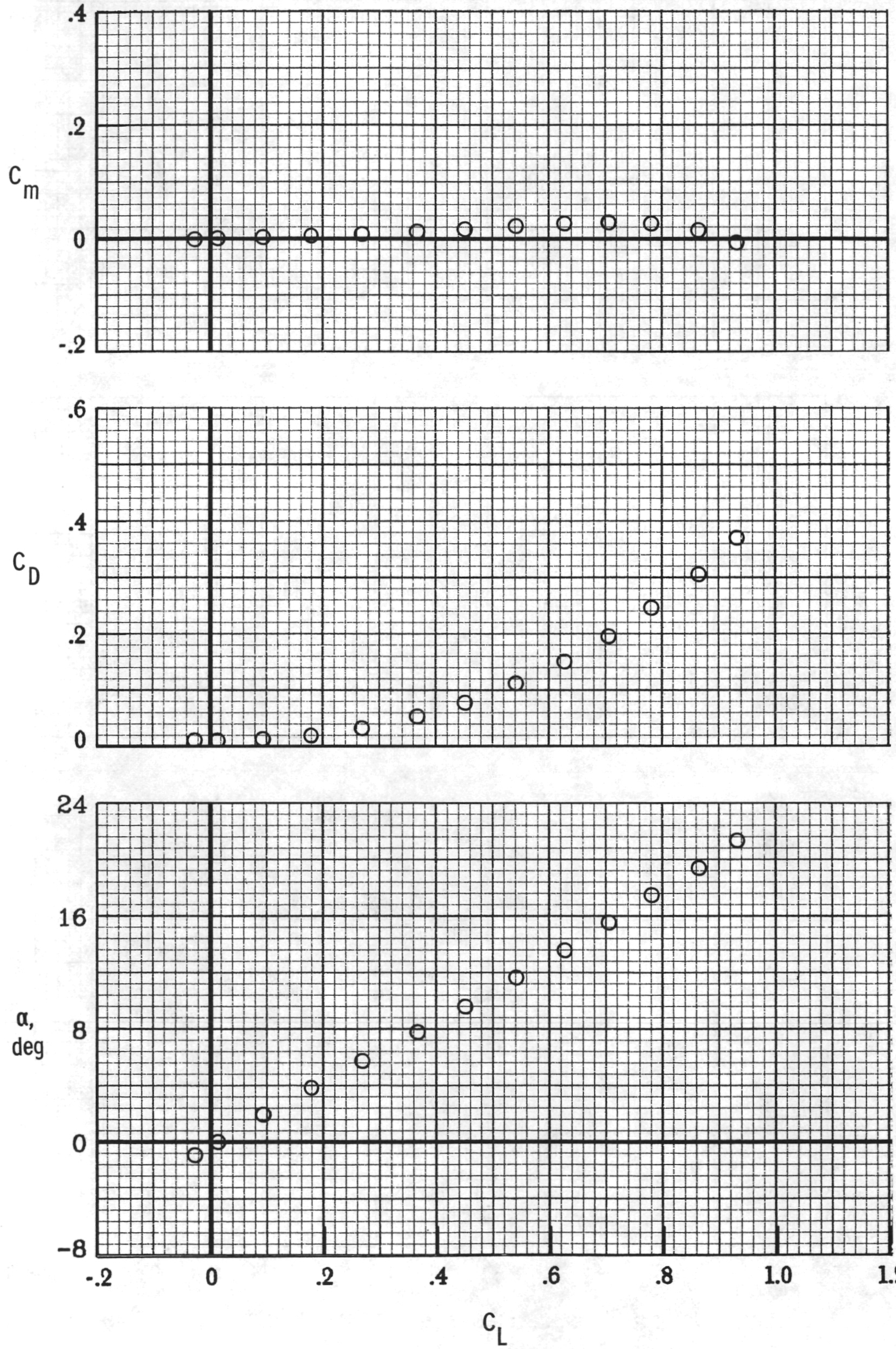
(g) Constant chord; high canard; $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 31.

Figure 9.- Continued.



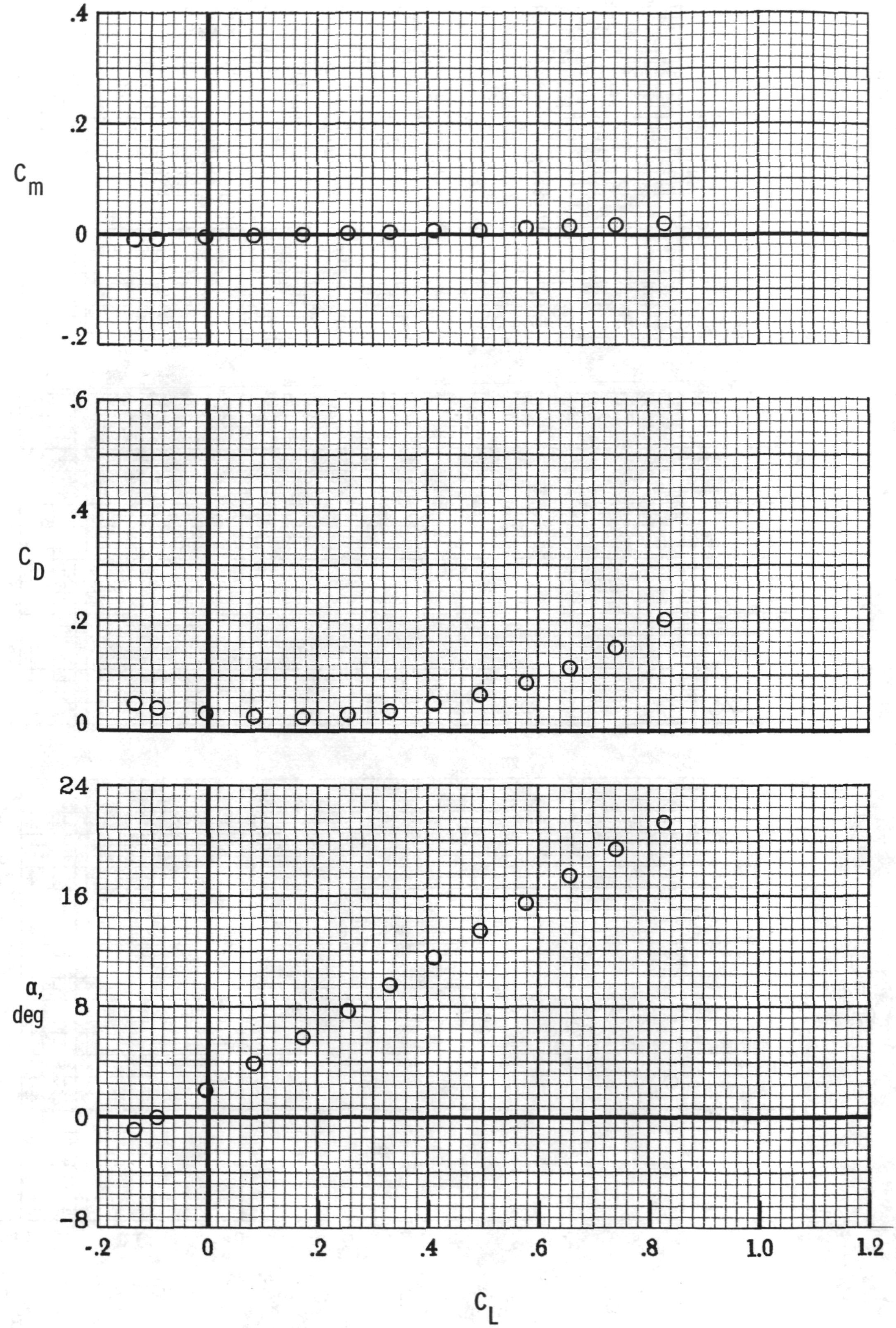
(h) Constant chord; high canard; δ_{LE} = 40°; δ_{TE} = 0°; run 32.

Figure 9.- Continued.



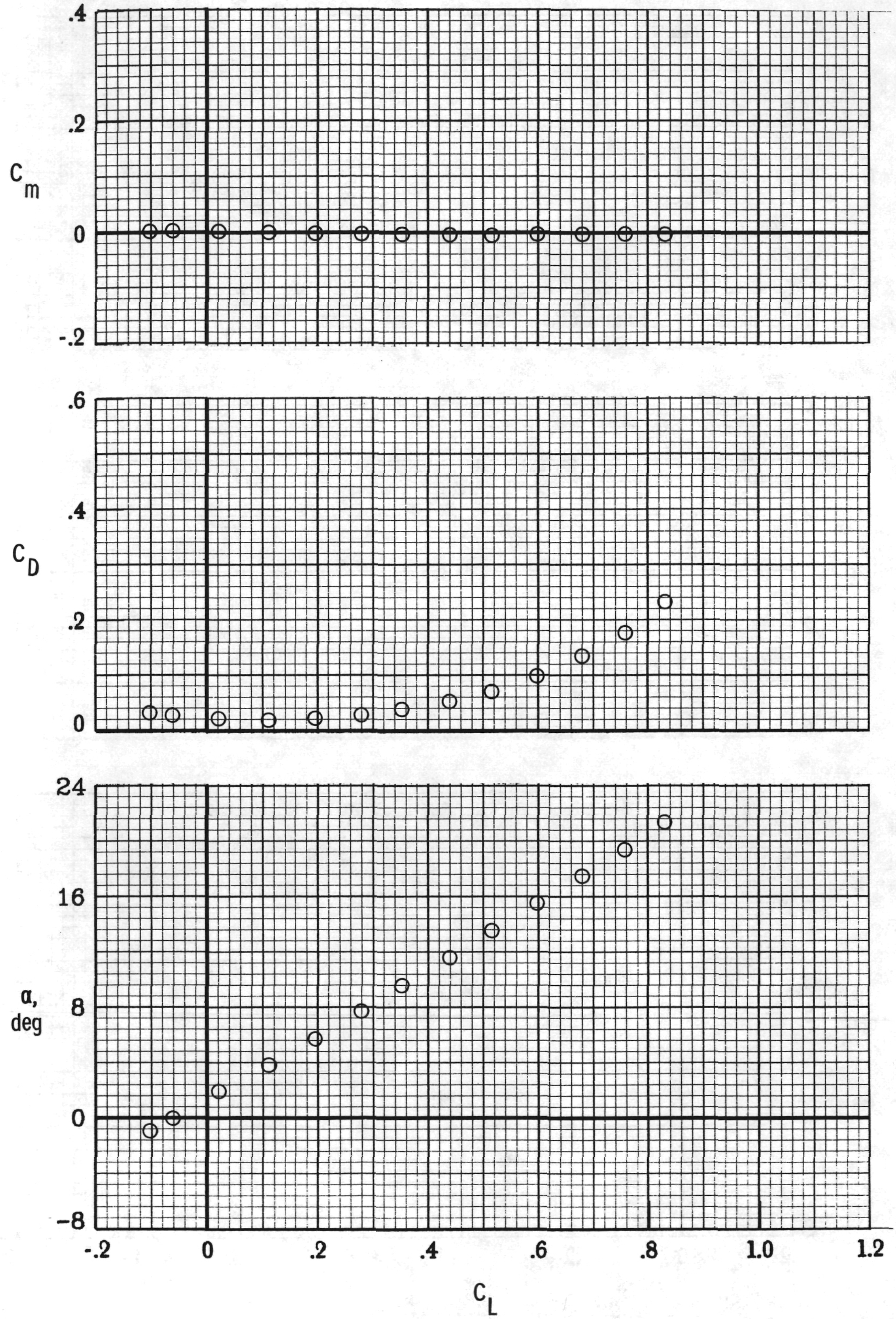
(i) Gothic; $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 21.

Figure 9.- Continued.



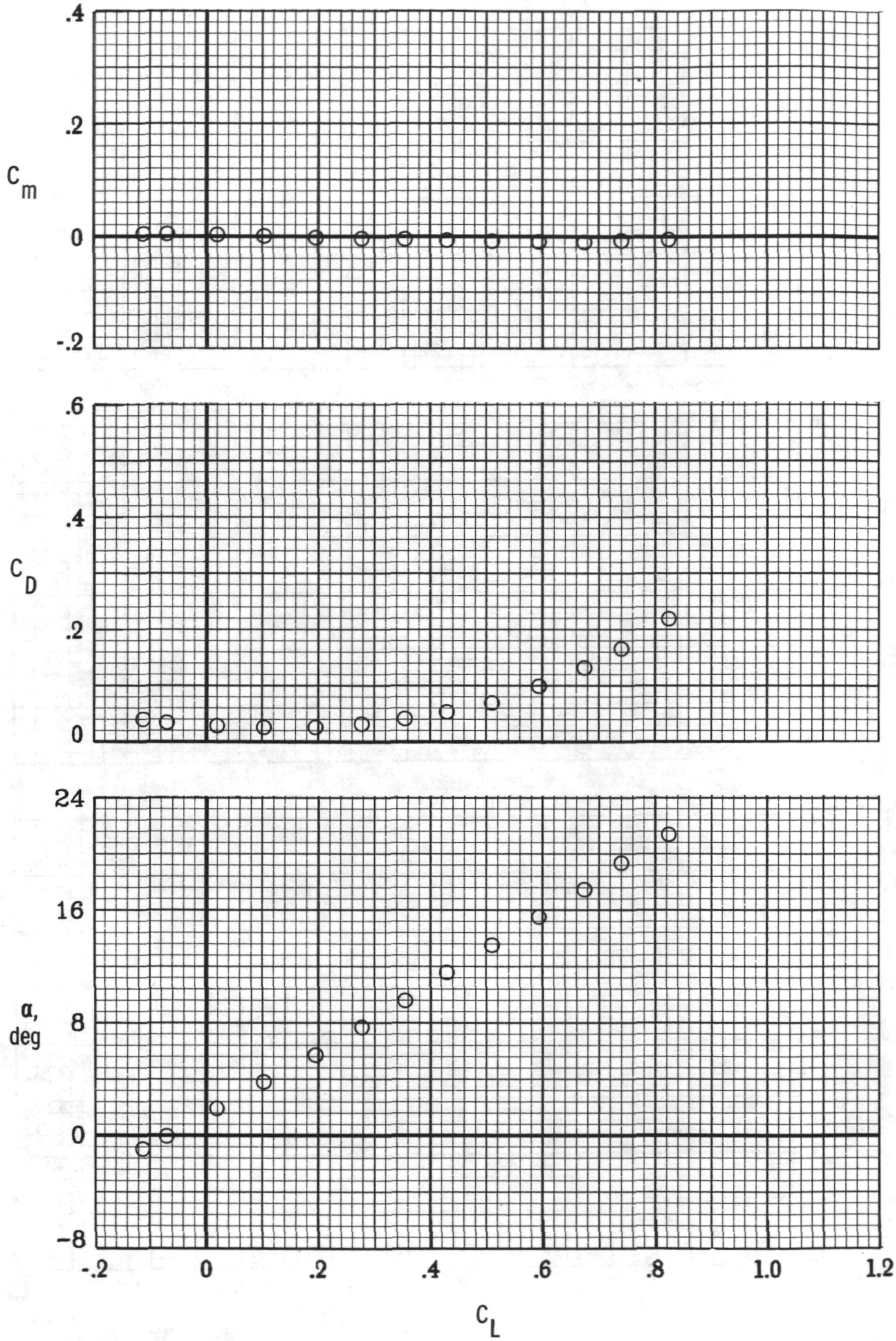
(j) Gothic; δ_{LE} = 40°; δ_{TE} = 0°; run 24.

Figure 9.- Continued.



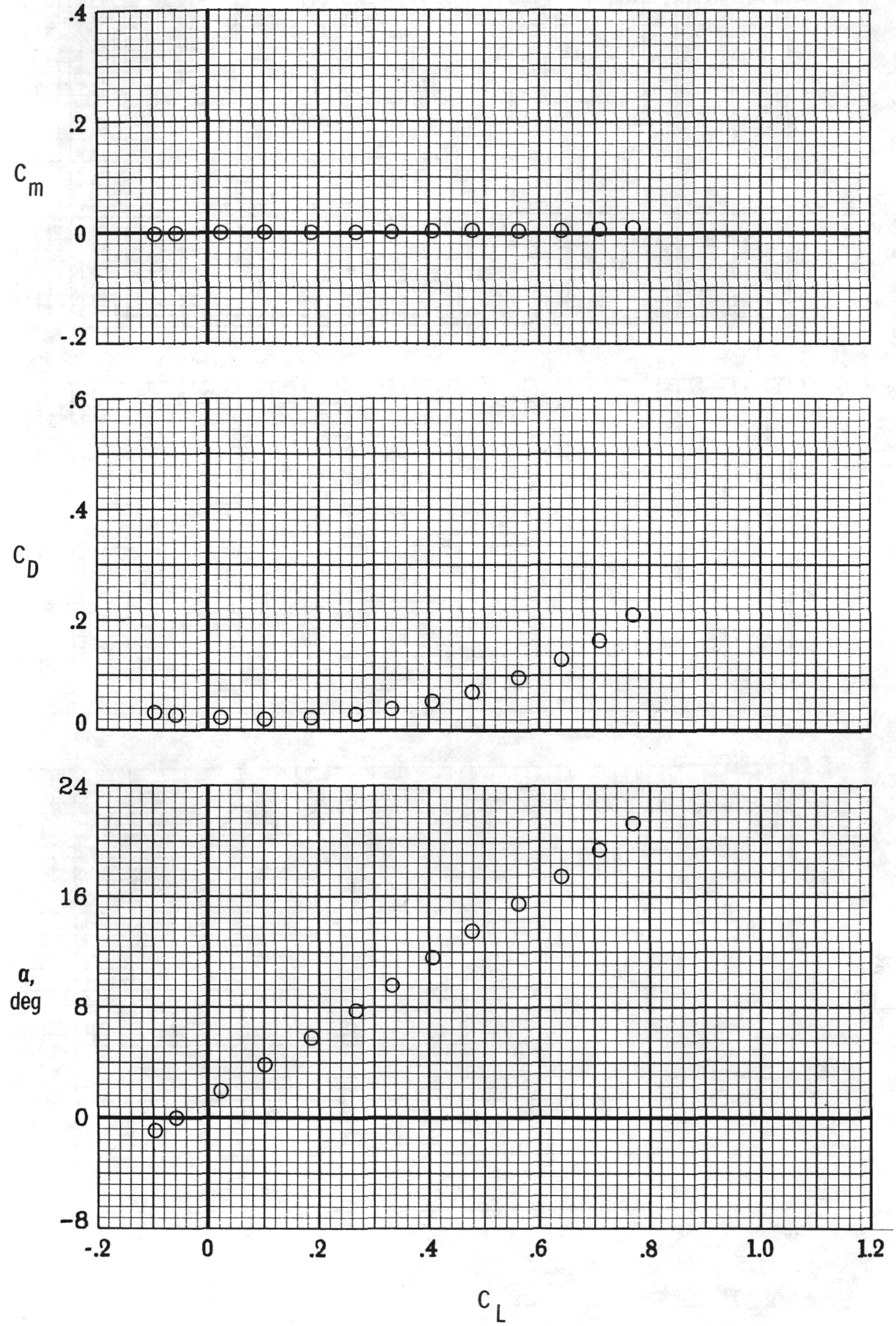
(k) Gothic - Mod 1; δ_{LE} = 40°; δ_{TE} = 0°; run 44.

Figure 9.- Continued.



(l) Gothic - Mod 2; $\delta_{LE} = 40°$; $\delta_{TE} = 0°$; run 45.

Figure 9.- Continued.



(m) Gothic - Mod 3; δ_{LE} = 40°; δ_{TE} = 0°; run 46.

Figure 9.- Concluded.

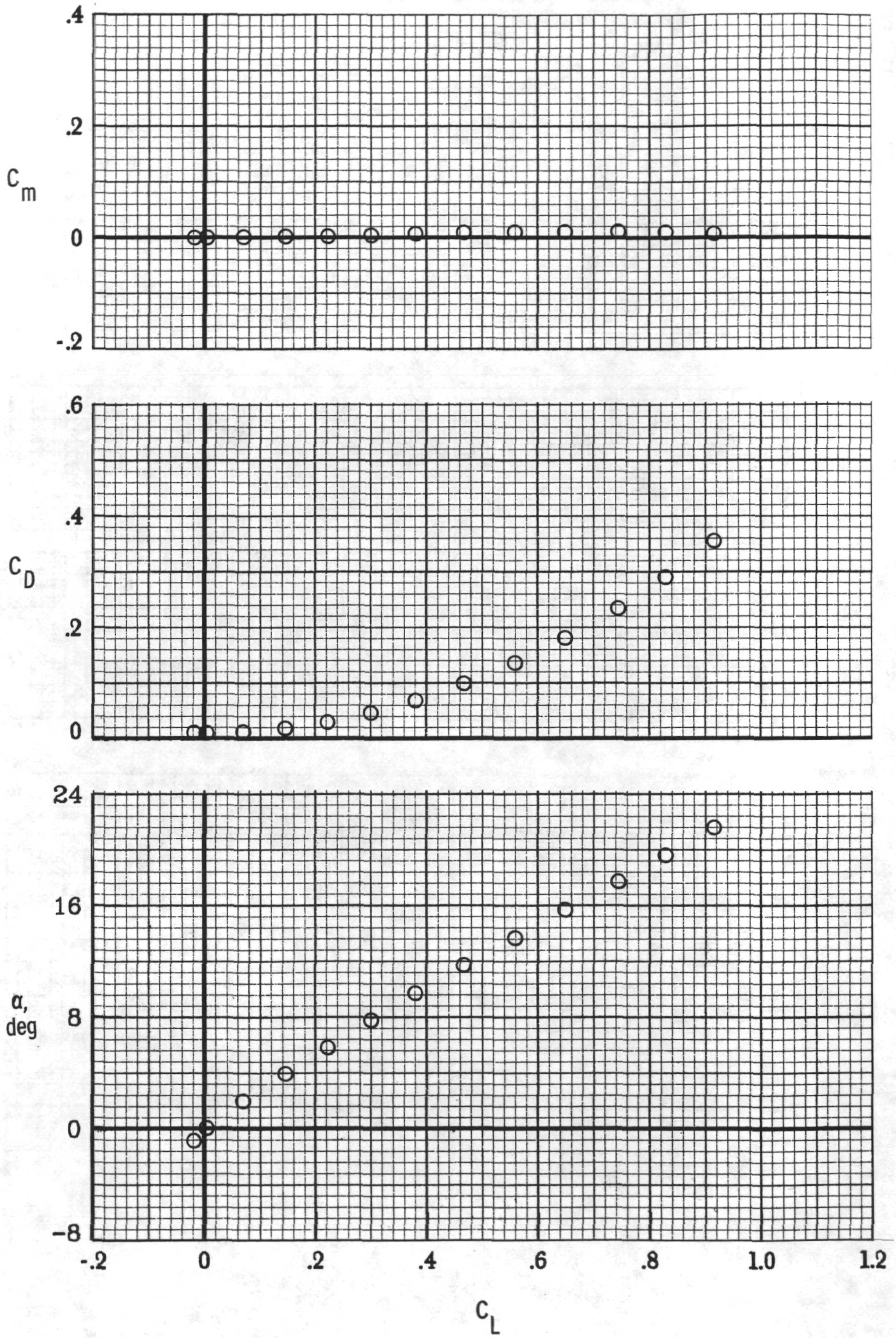
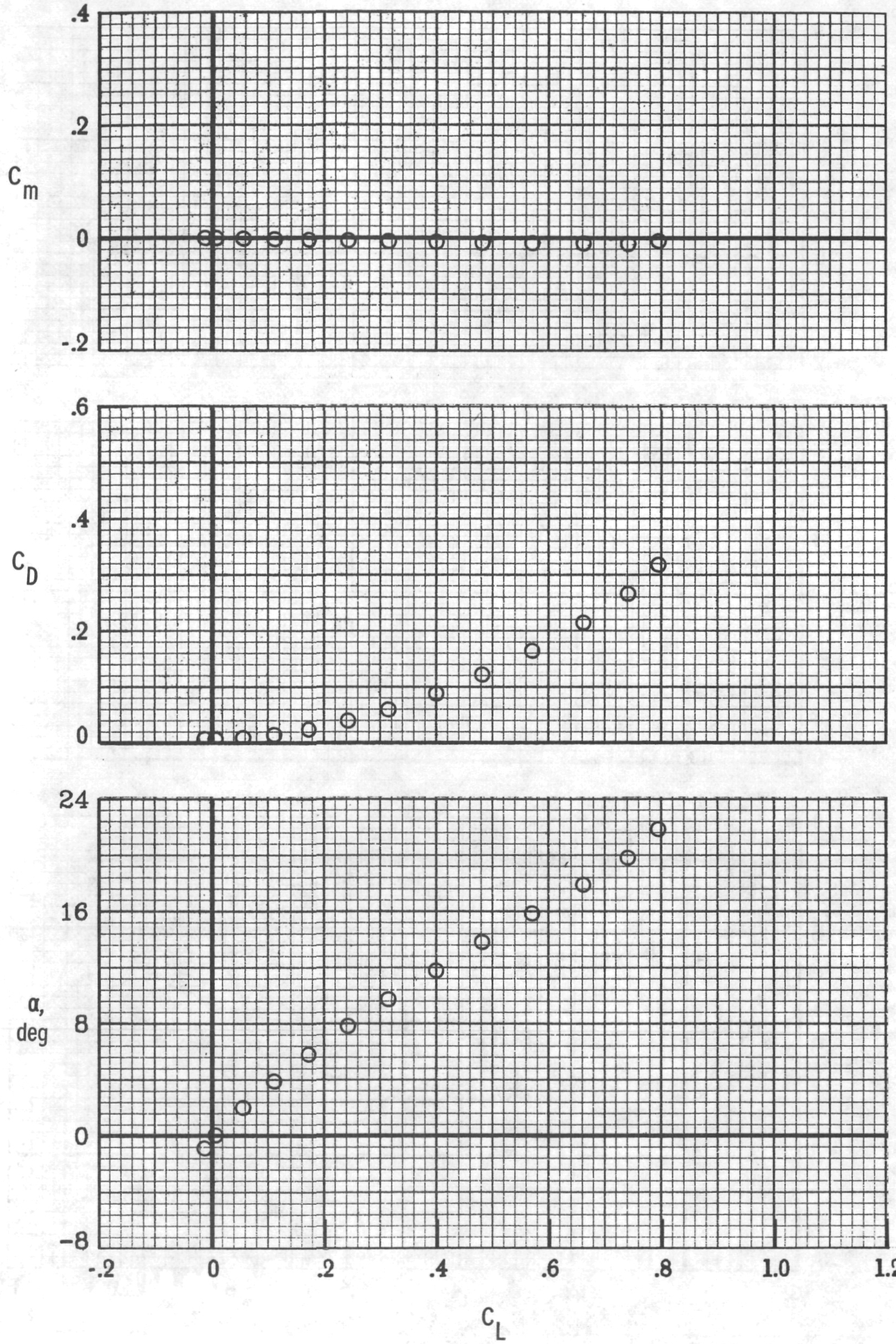
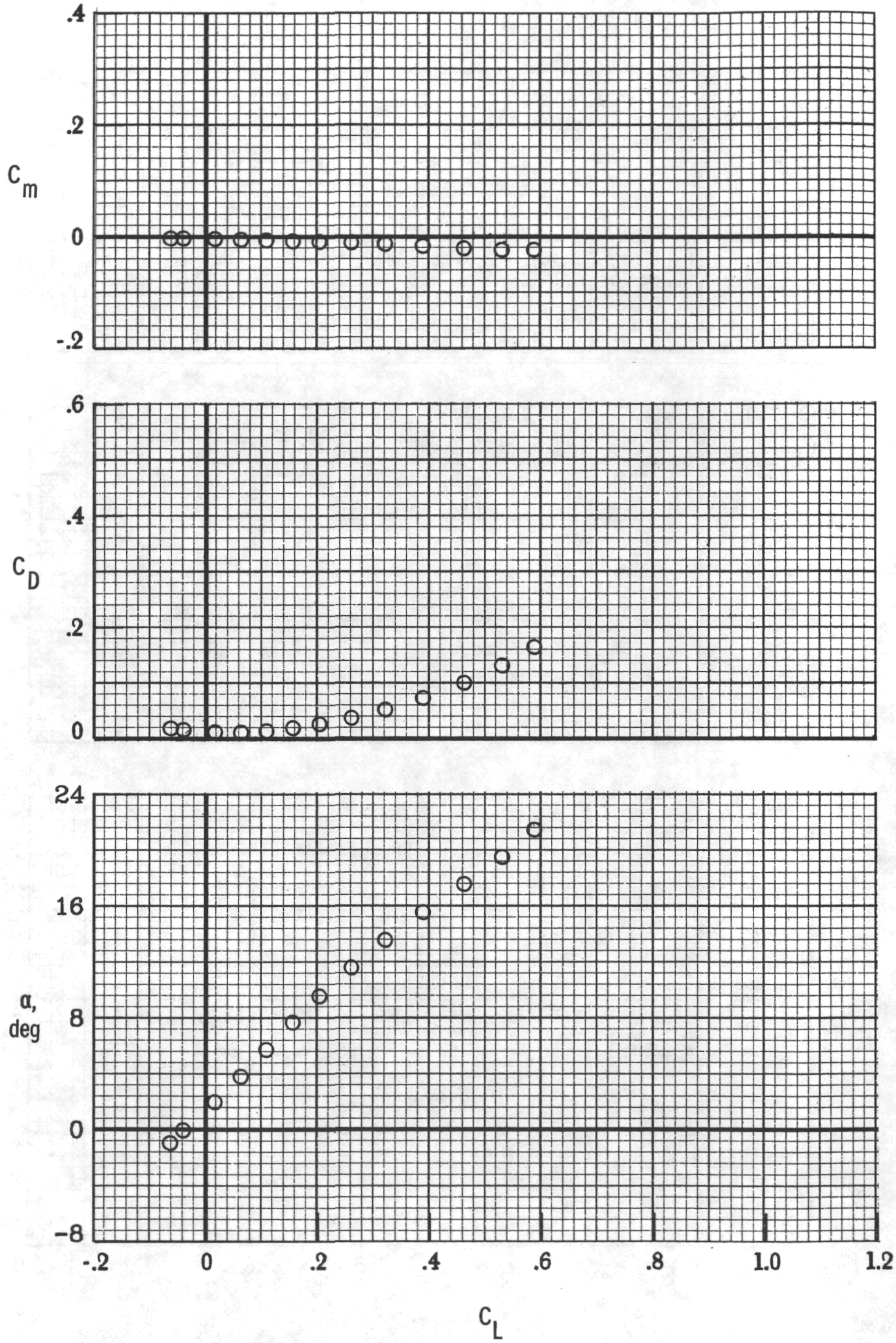


Figure 10.- Static longitudinal data for 66° delta wing with constant-chord LEVF. $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 6.



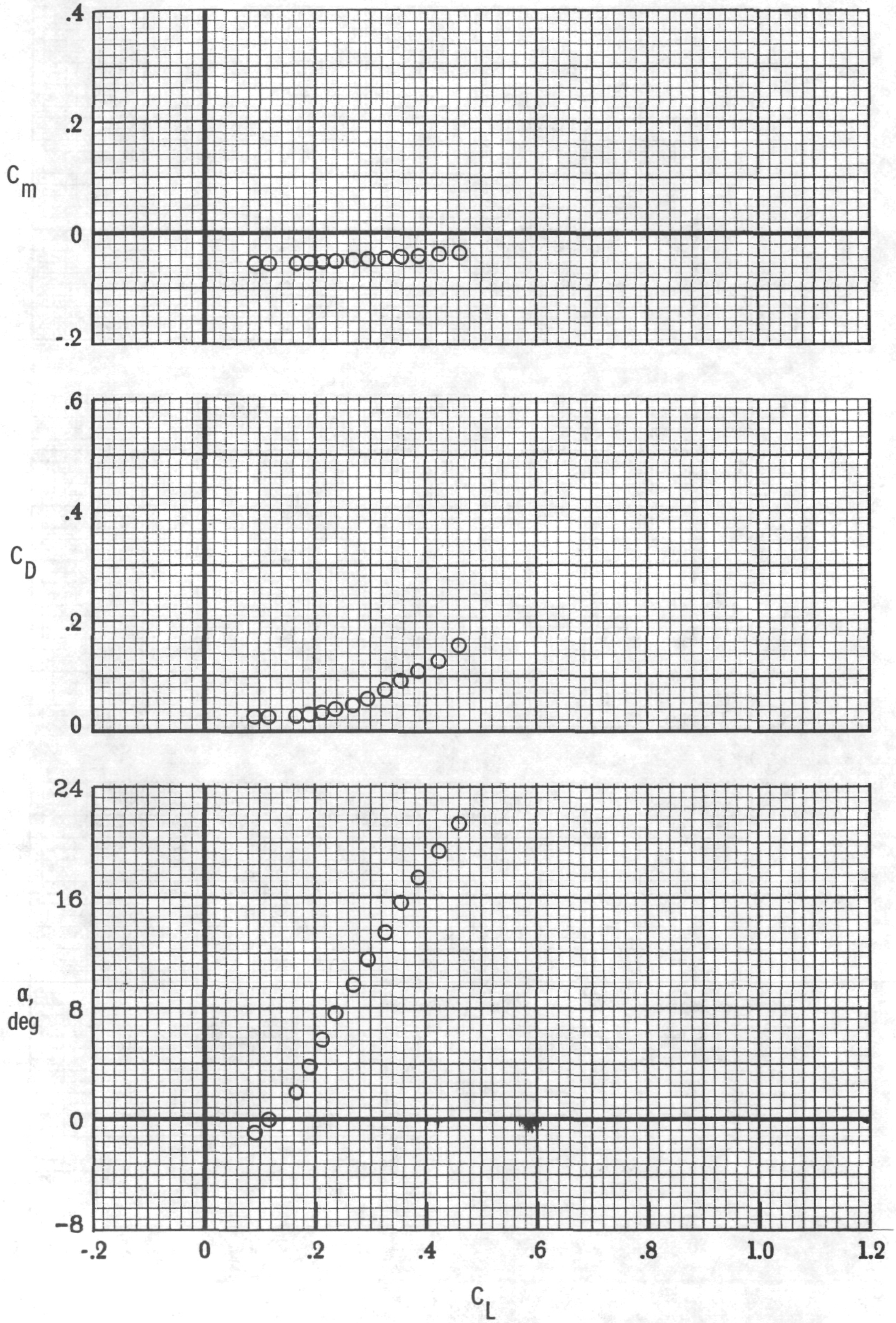
(a) Constant chord; $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 16.

Figure 11.- Static longitudinal data for 74° delta wing with LEVF.



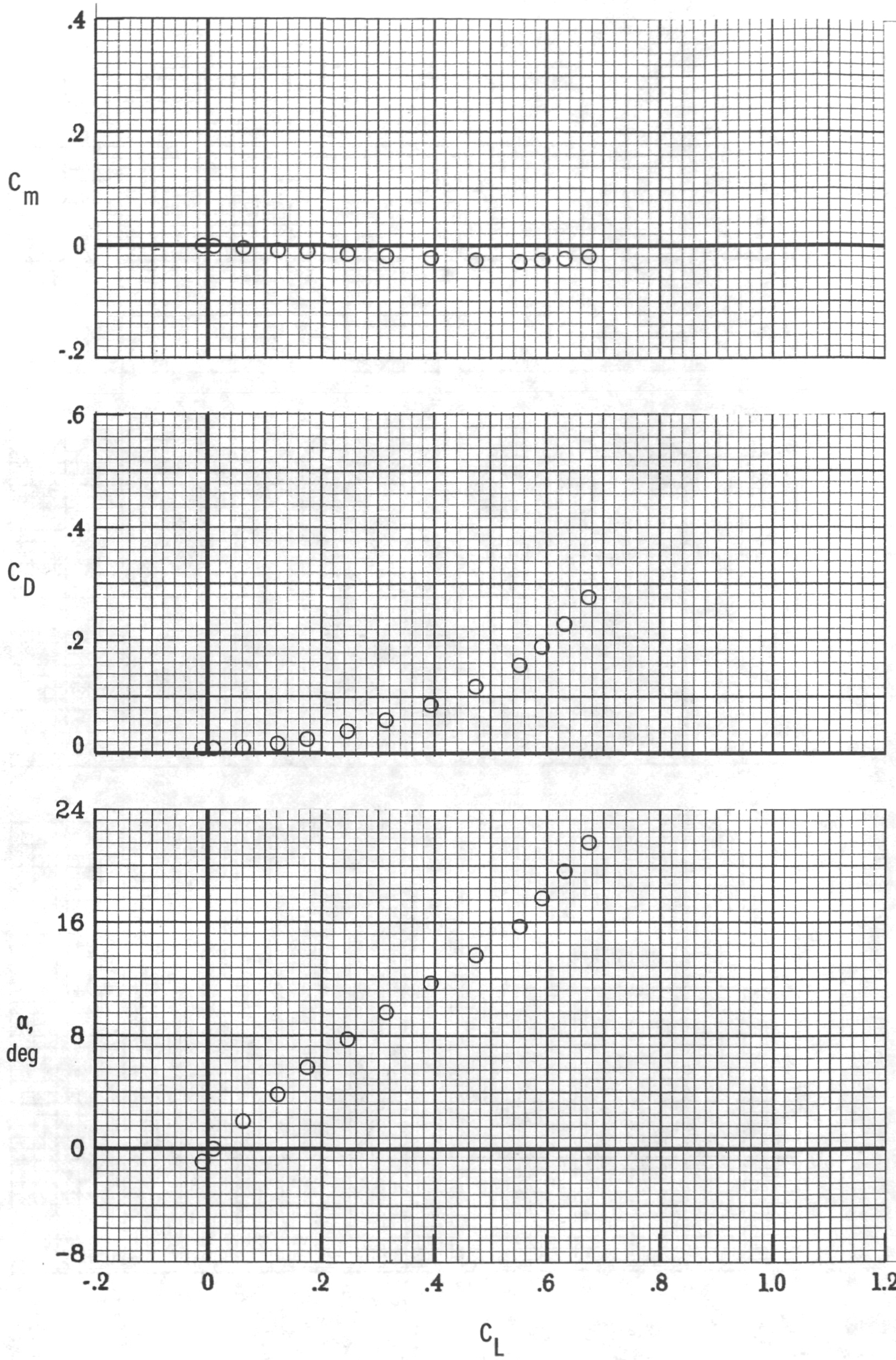
(b) Constant chord; δ_{LE} = 40°; δ_{TE} = 0°; run 19.

Figure 11.- Continued.



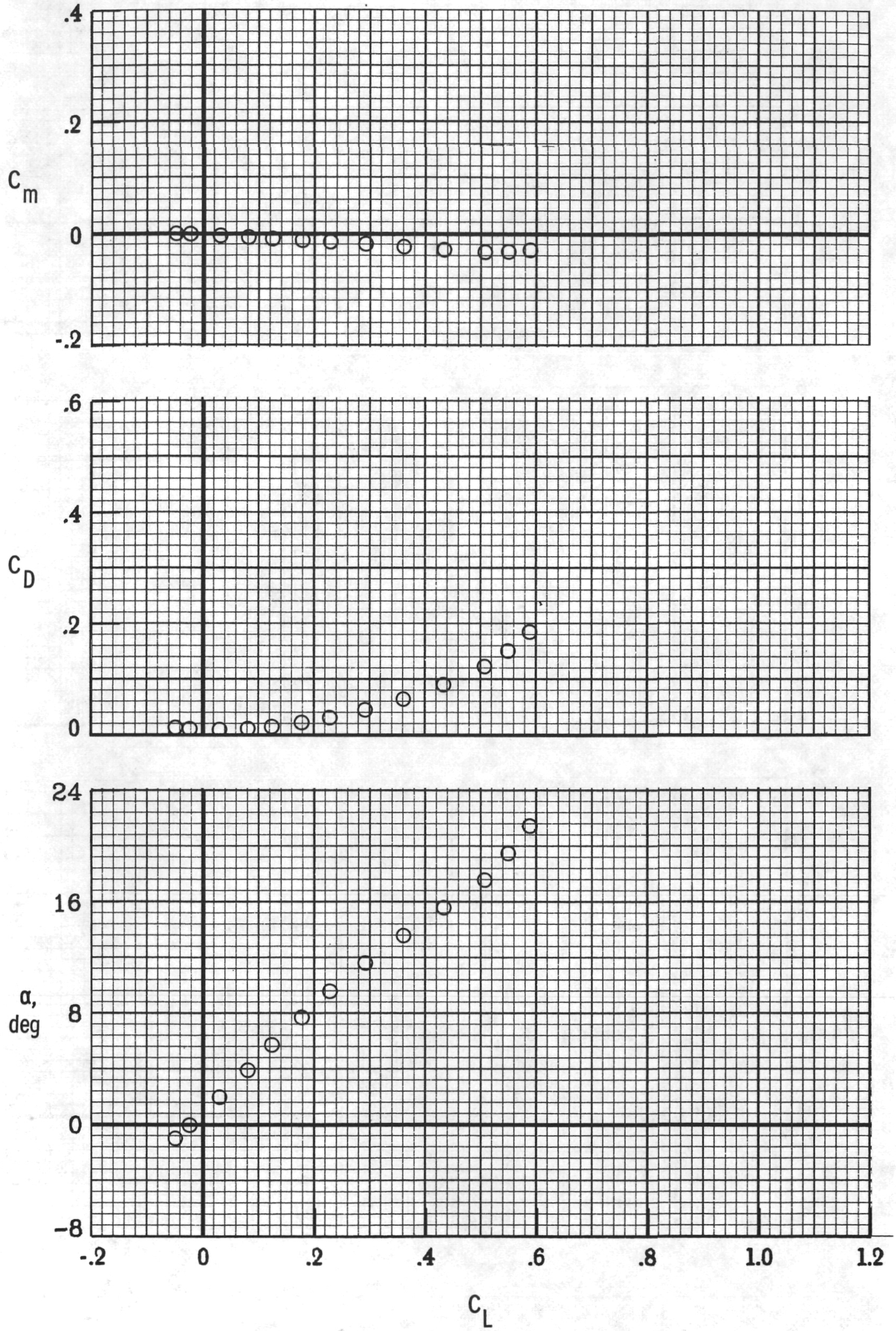
(c) Constant chord; δ_{LE} = 40°; δ_{TE} = 20°; run 20.

Figure 11.- Continued.



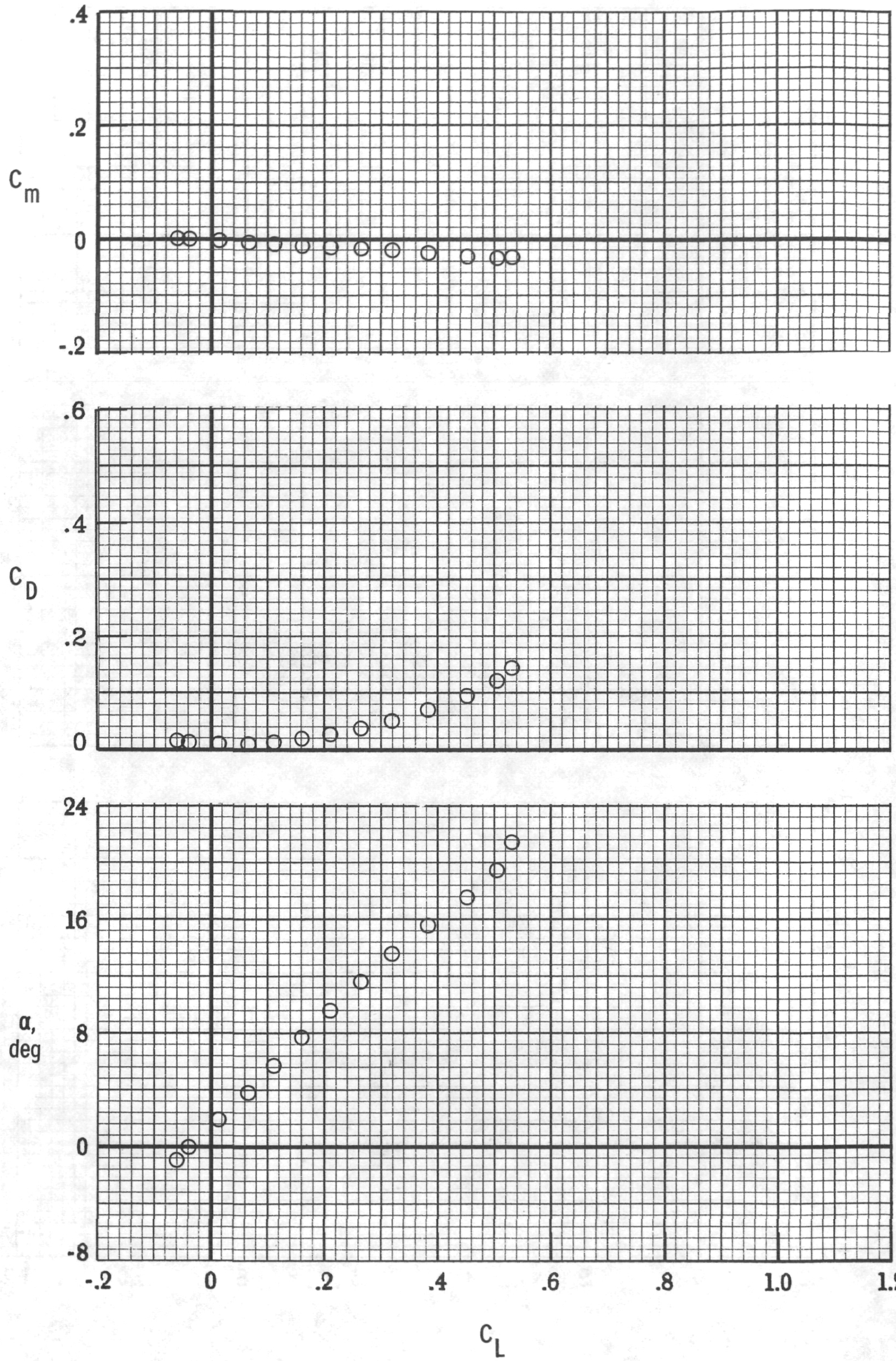
(d) Gothic; $\delta_{LE} = 0°$; $\delta_{TE} = 0°$; run 36.

Figure 11.- Continued.



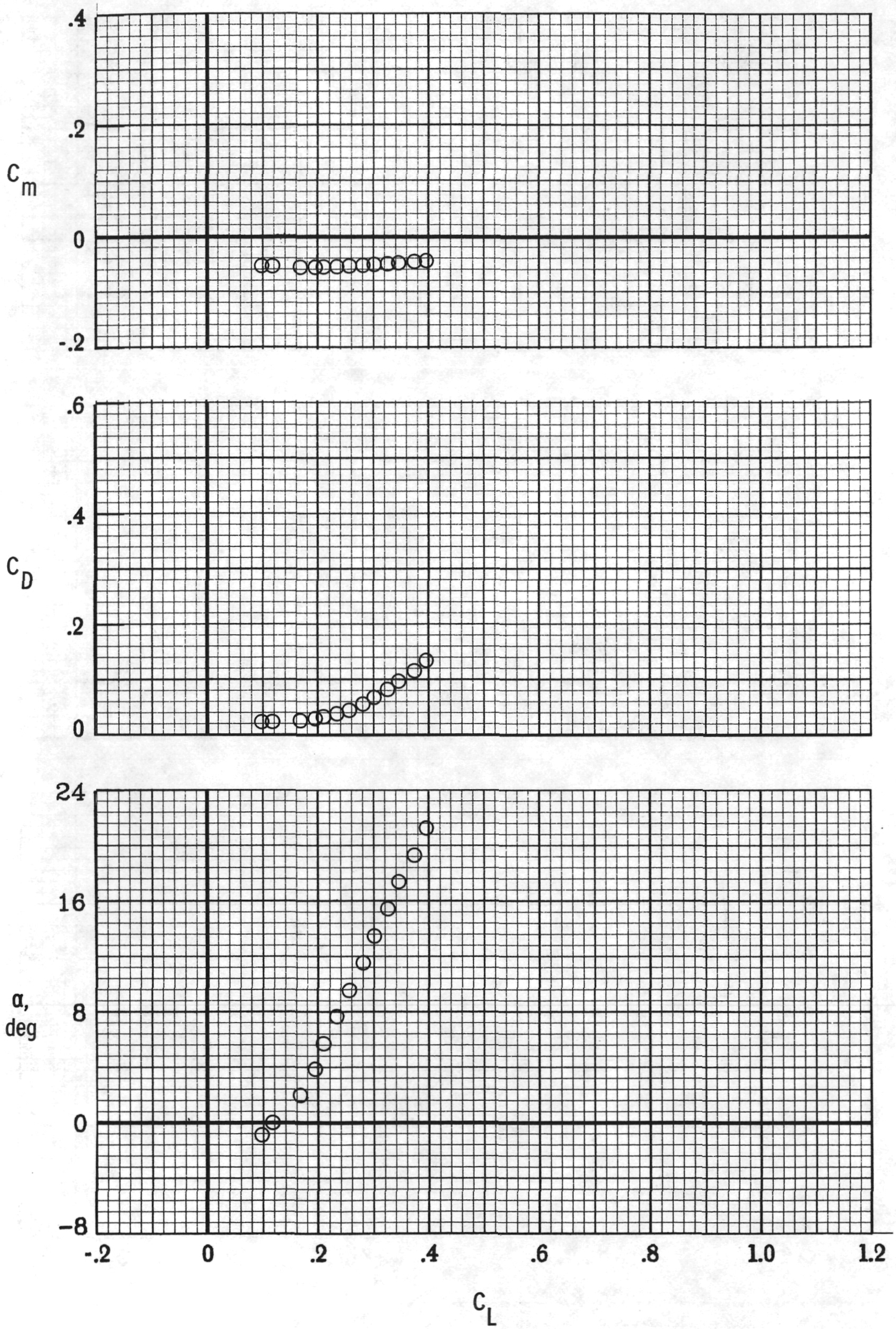
(e) Gothic; δ_{LE} = 30°; δ_{TE} = 0°; run 41.

Figure 11.- Continued.



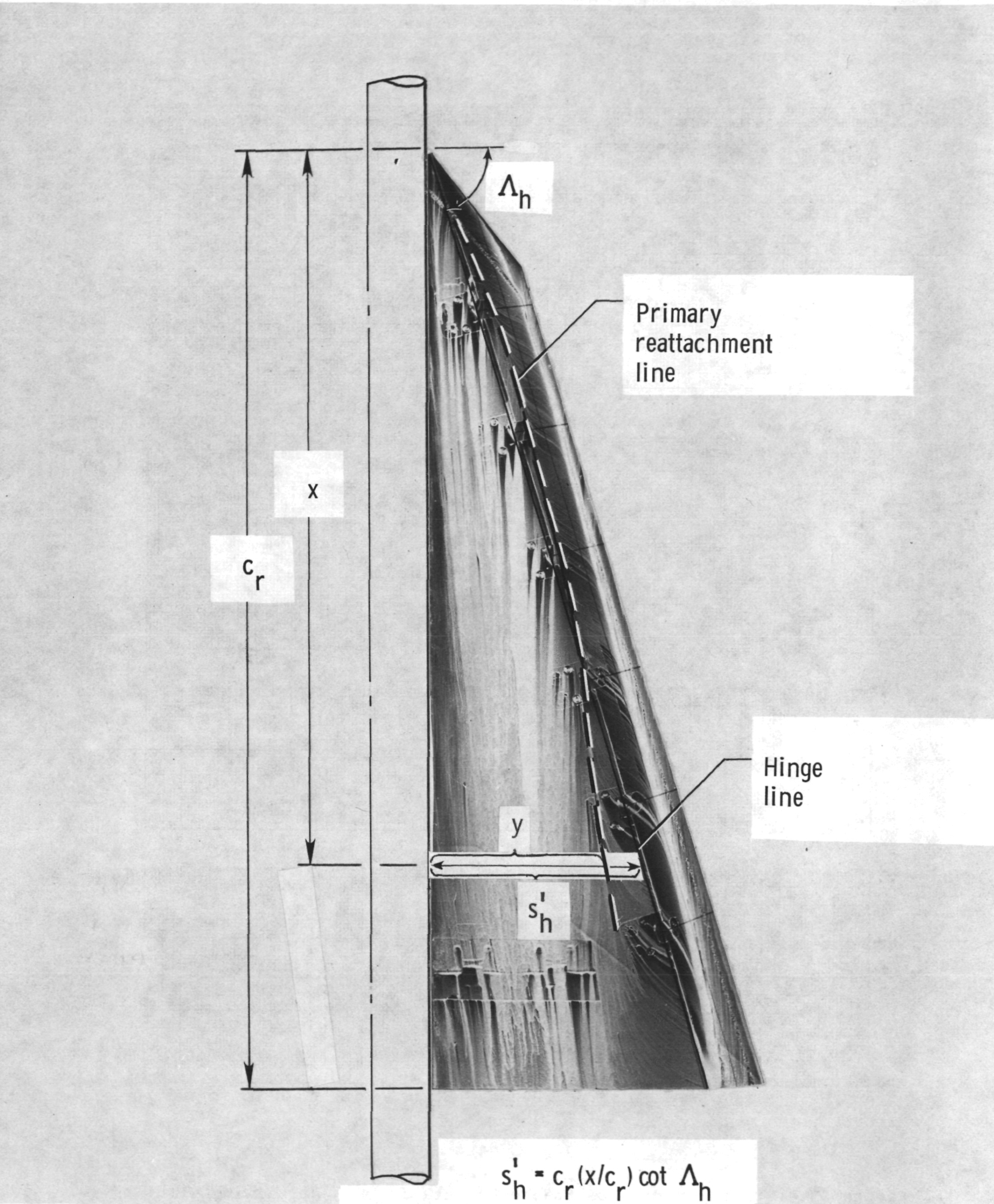
(f) Gothic; $\delta_{LE} = 40°$; $\delta_{TE} = 0°$; run 39.

Figure 11.- Continued.



(g) Gothic; δ_{LE} = 40°; δ_{TE} = 20°; run 40.

Figure 11.- Concluded.



L-83-135

Figure 12.- Representative oil flow photograph and pertinent dimensional parameters. Constant-chord flap; $\delta_{LE} = 40°$; $\delta_{TE} = 0°$; $\Lambda_h = 74°$; $\alpha = 14°$.

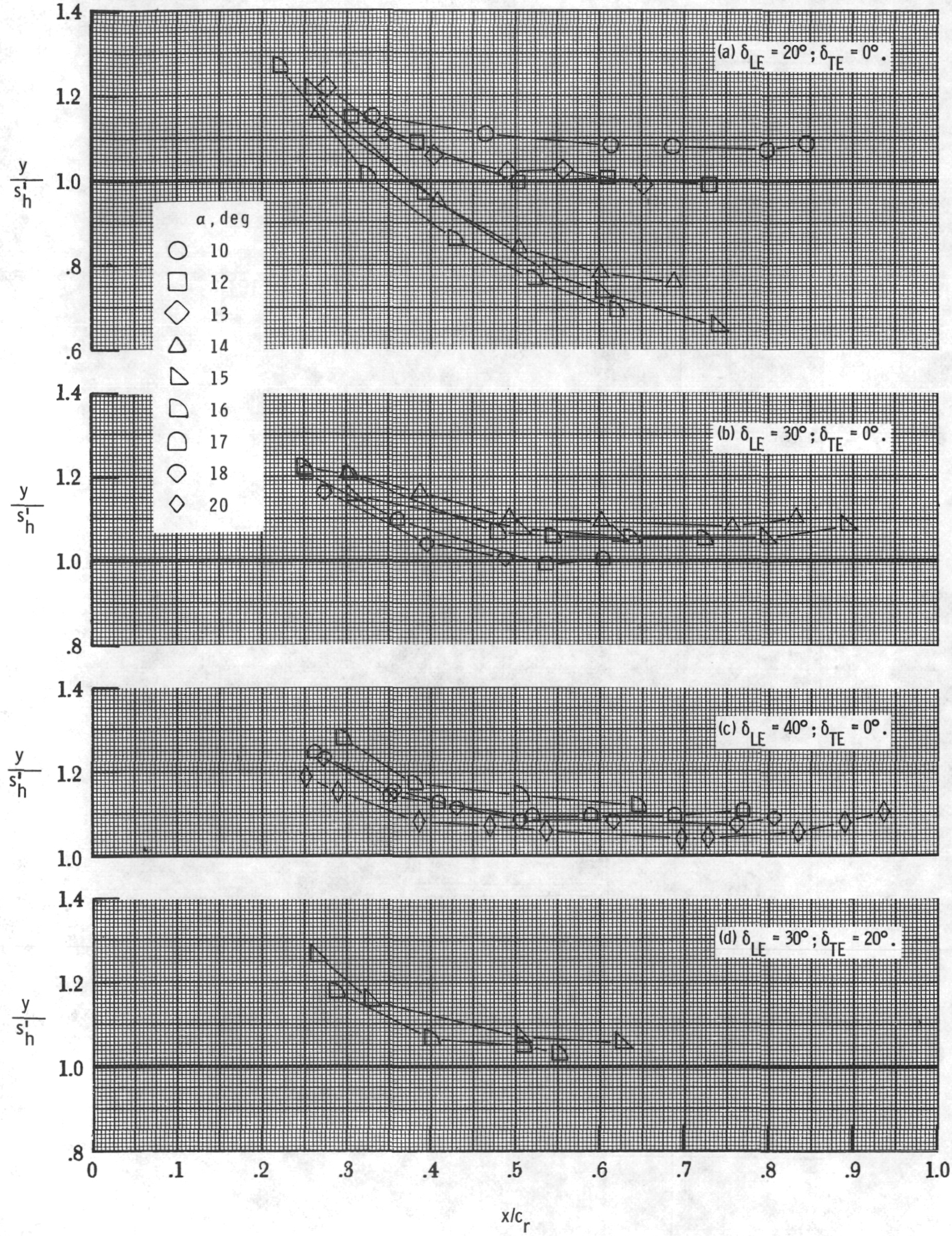


Figure 13.- Primary vortex reattachment data for 50° delta wing with constant-chord LEVF.

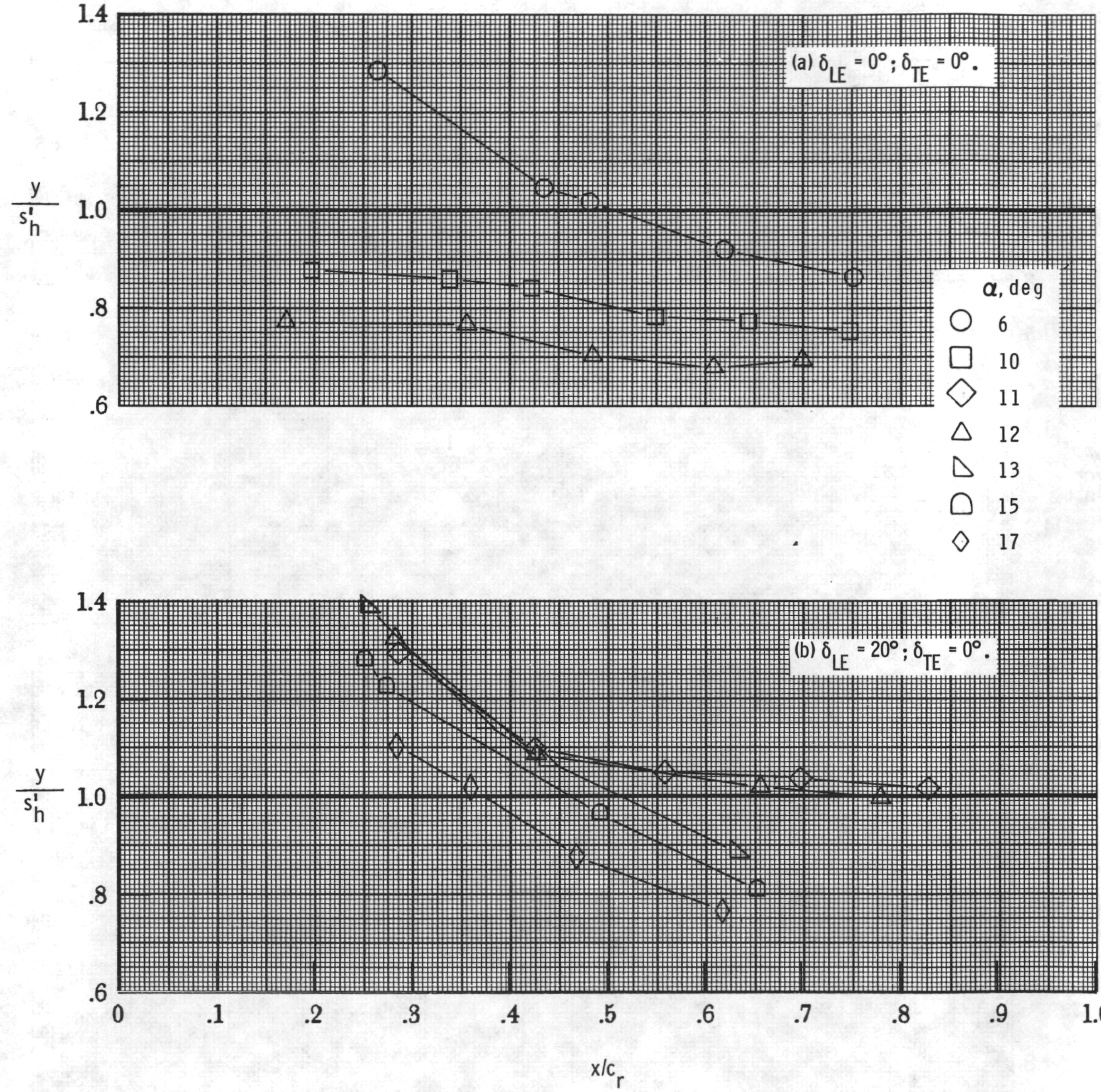


Figure 14.- Primary vortex reattachment data for 58° delta wing with constant-chord LEVF.

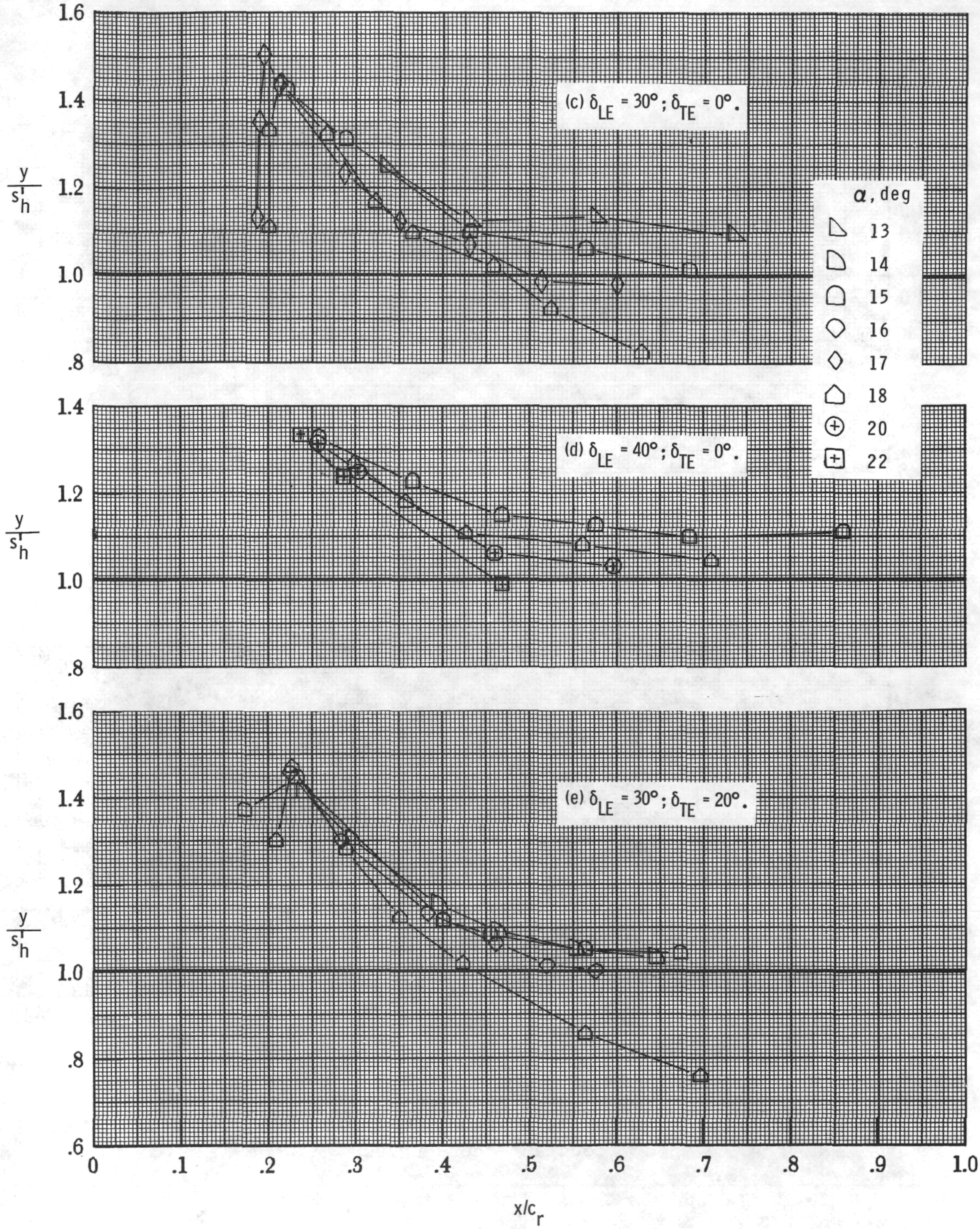


Figure 14.- Concluded.

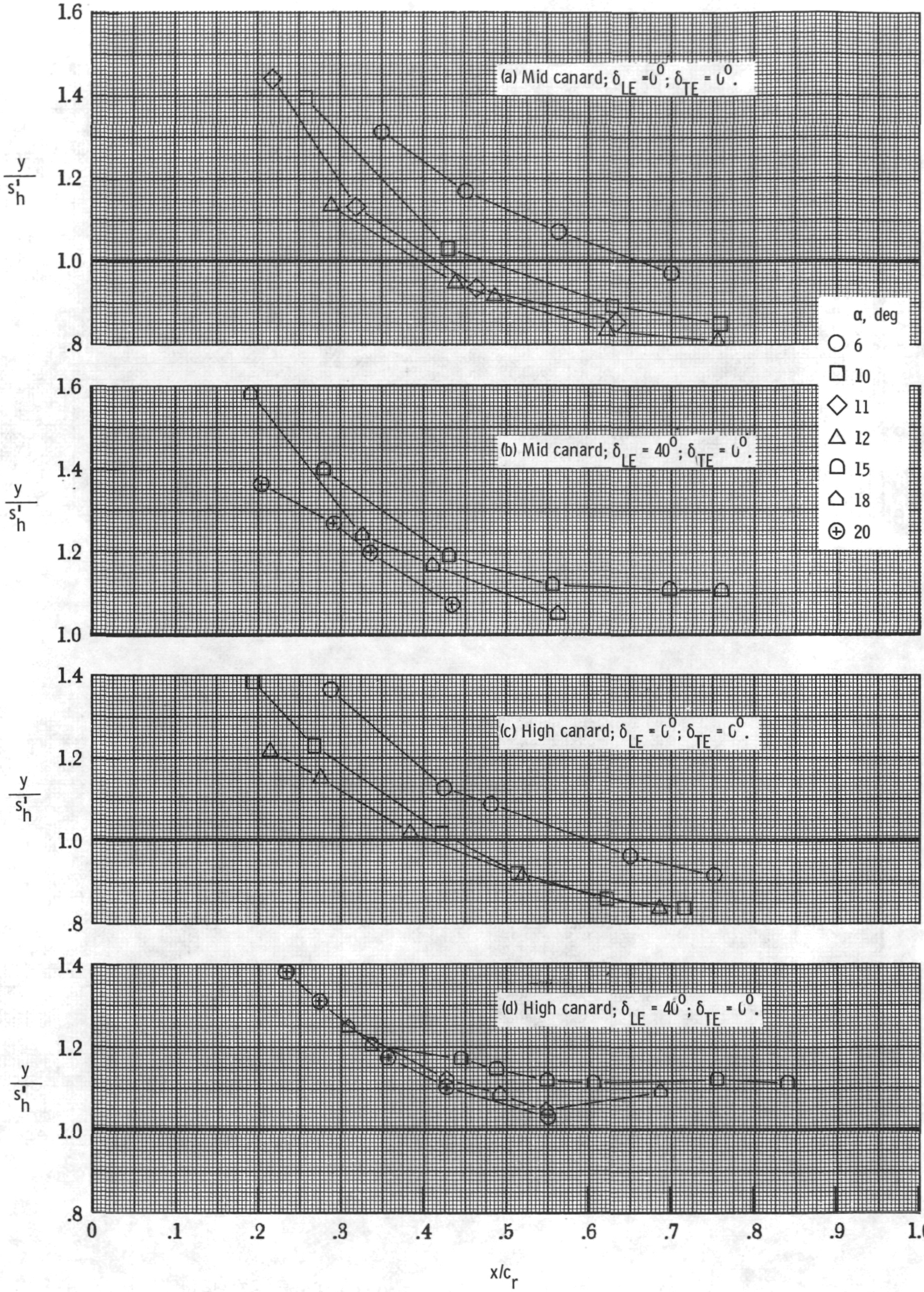


Figure 15.- Primary vortex reattachment data for 58° delta wing with constant-chord LEVF; mid- and high-canard configurations.

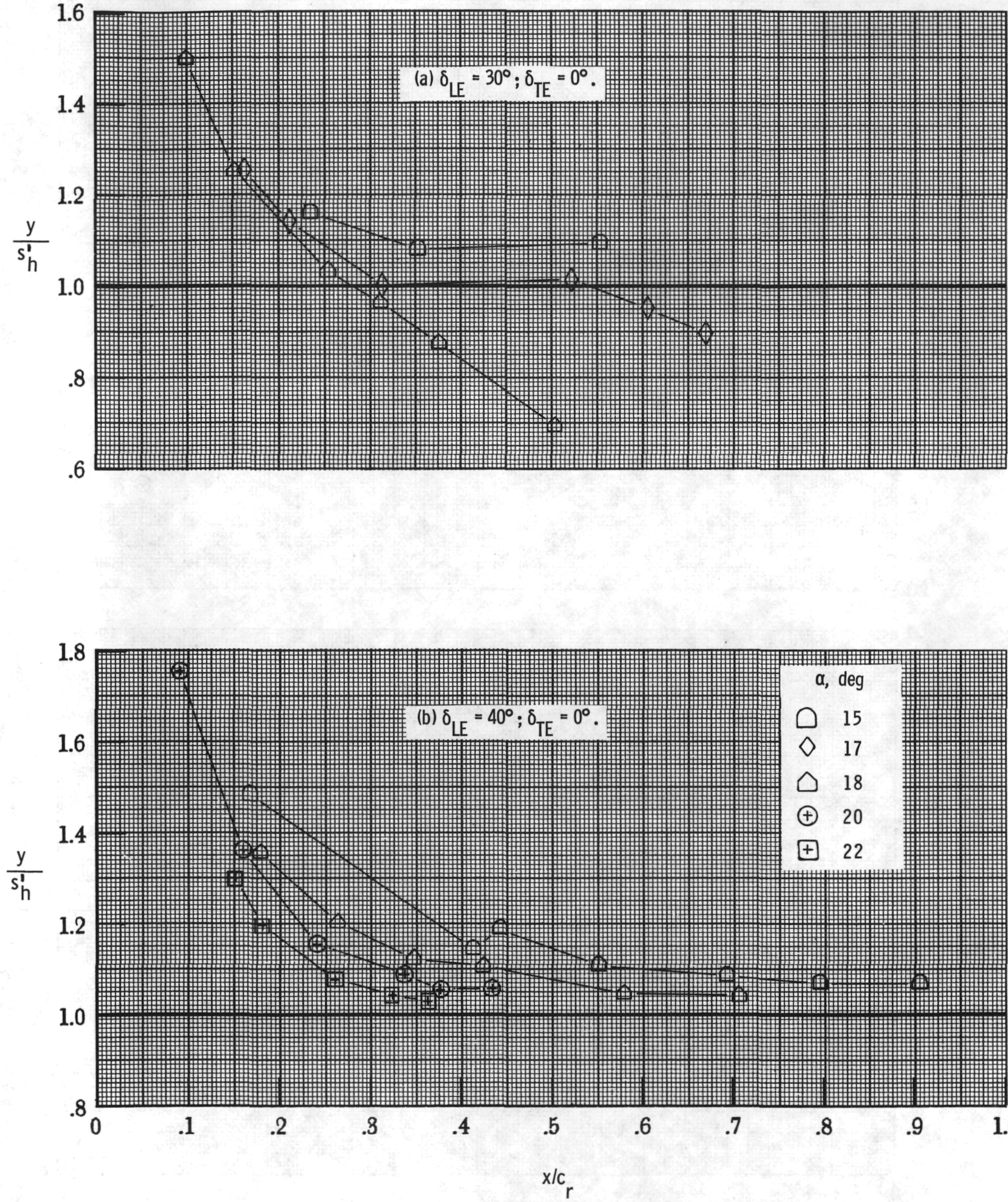


Figure 16.- Primary vortex reattachment data for 58° delta wing with constant-chord (with extension) LEVF.

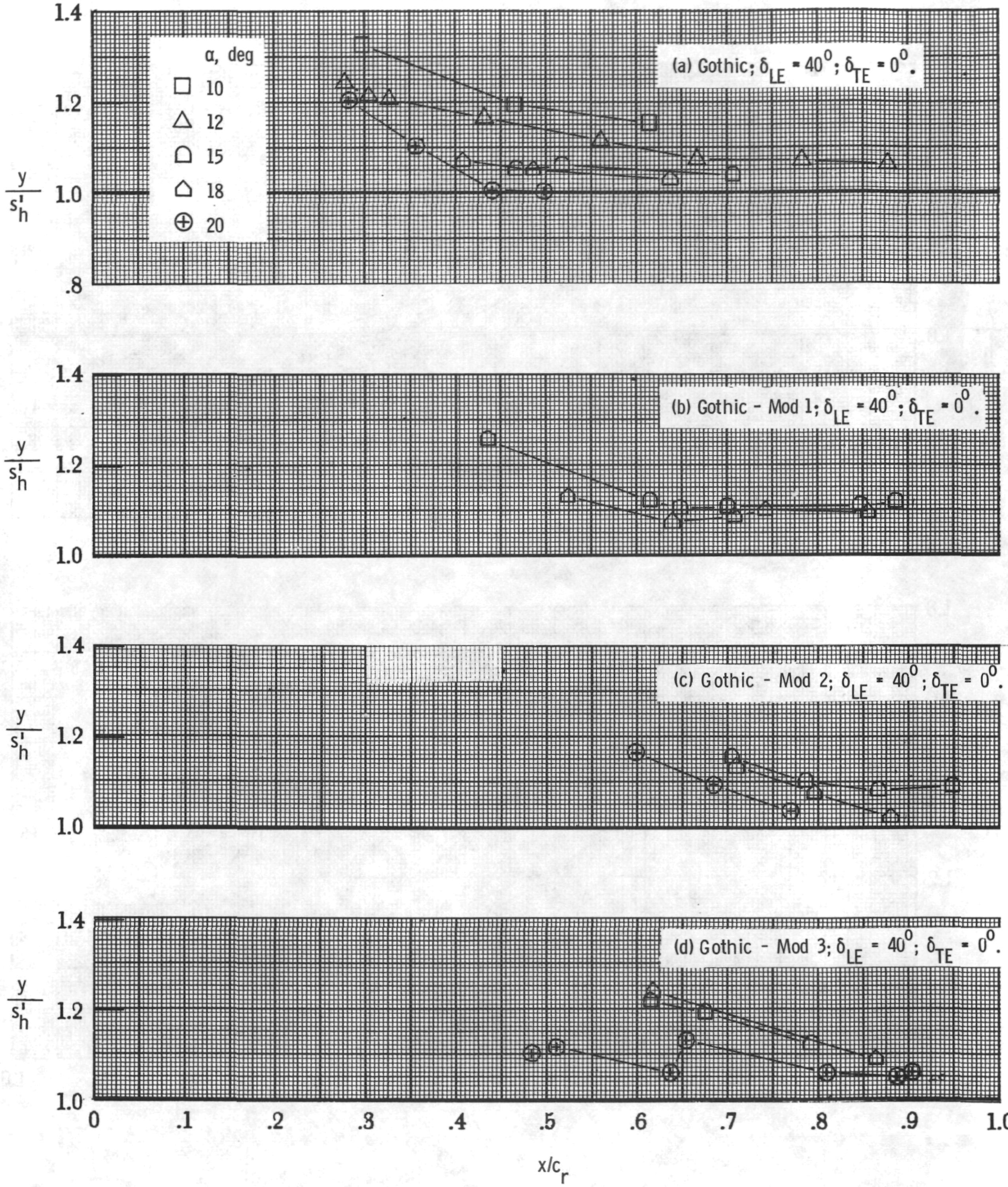


Figure 17.- Primary vortex reattachment data for 58° delta wing with gothic and modified gothic LEVF.

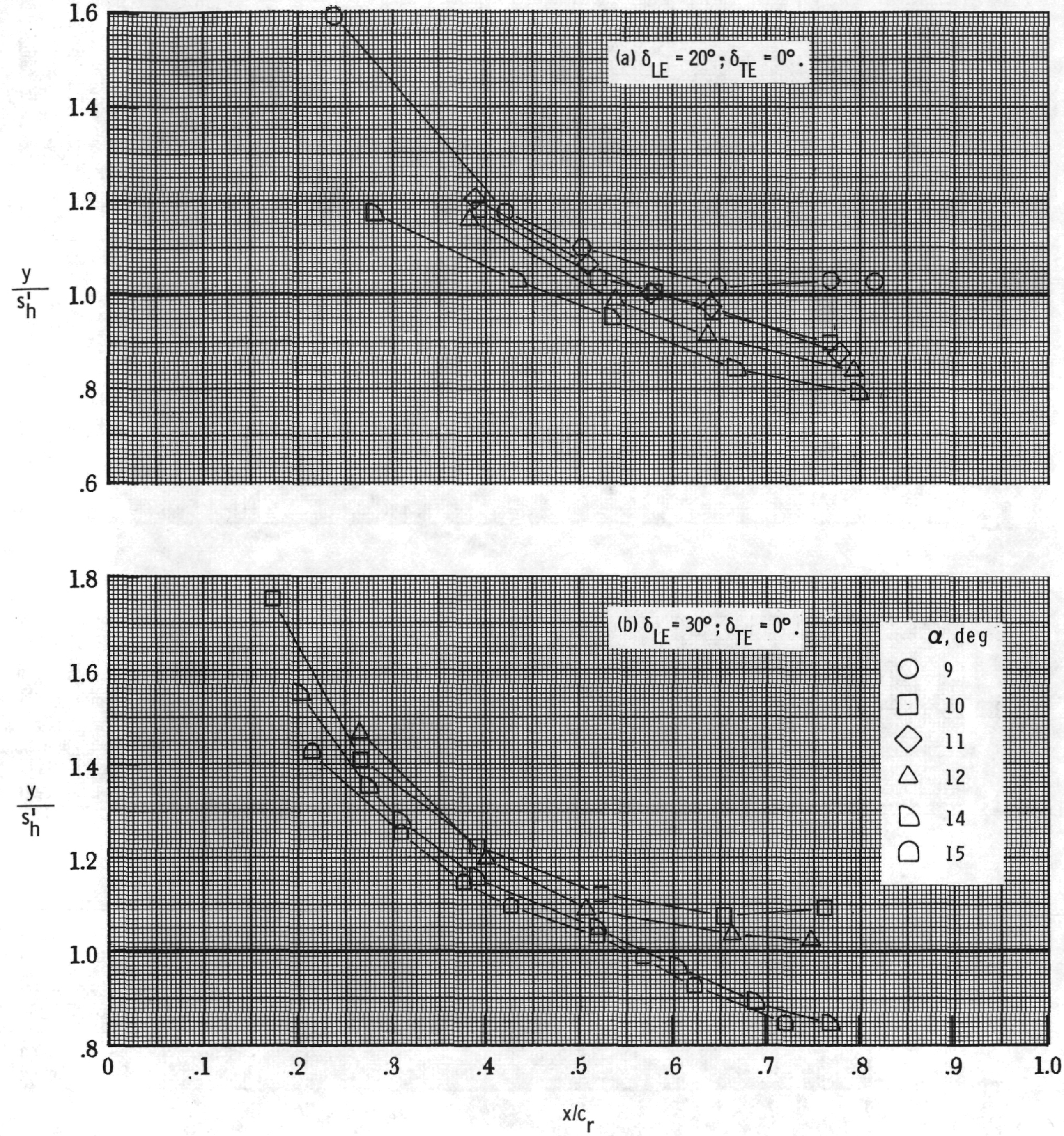


Figure 18.- Primary vortex reattachment data for 66° delta wing with constant-chord LEVF.

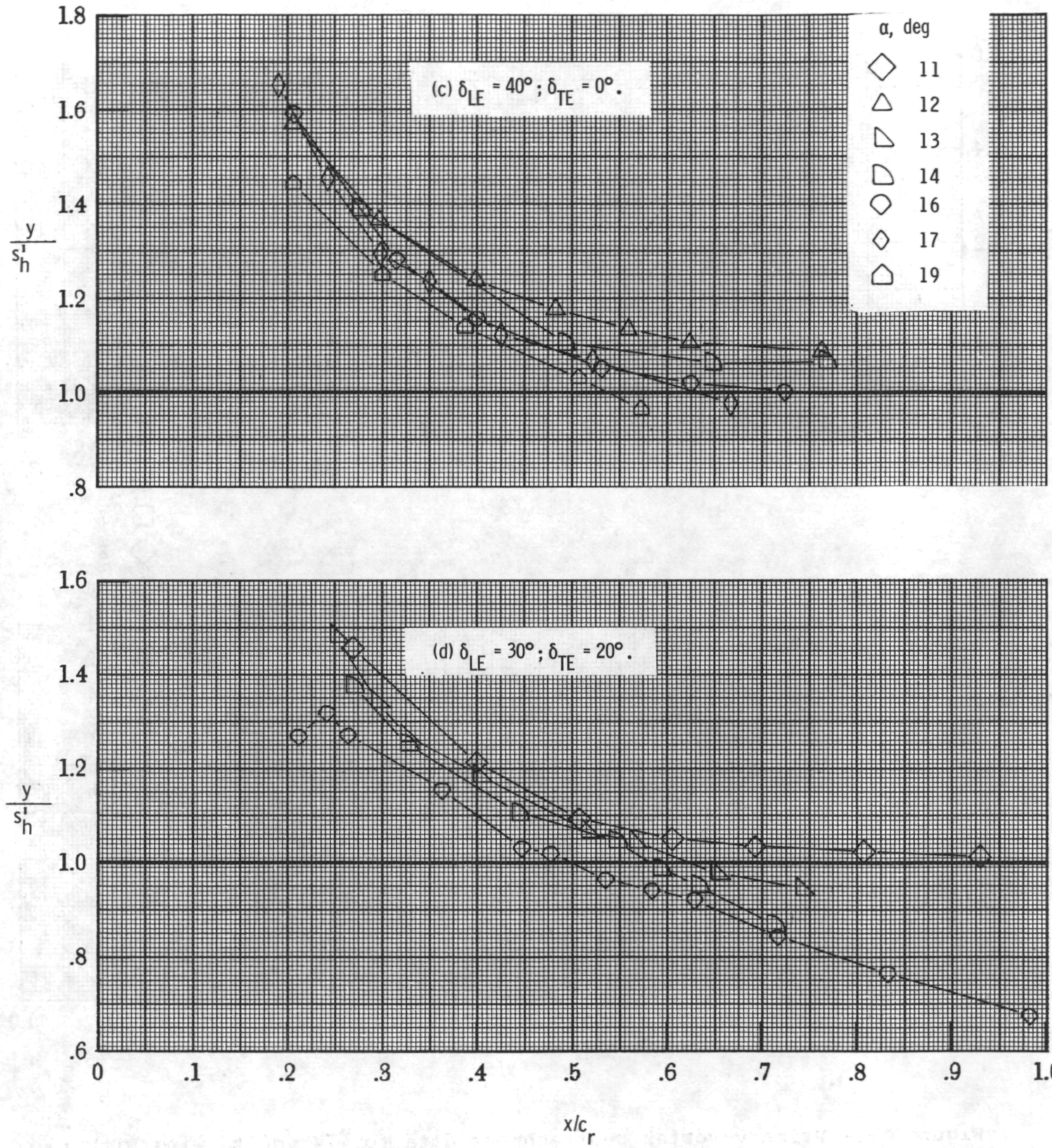


Figure 18.- Concluded.

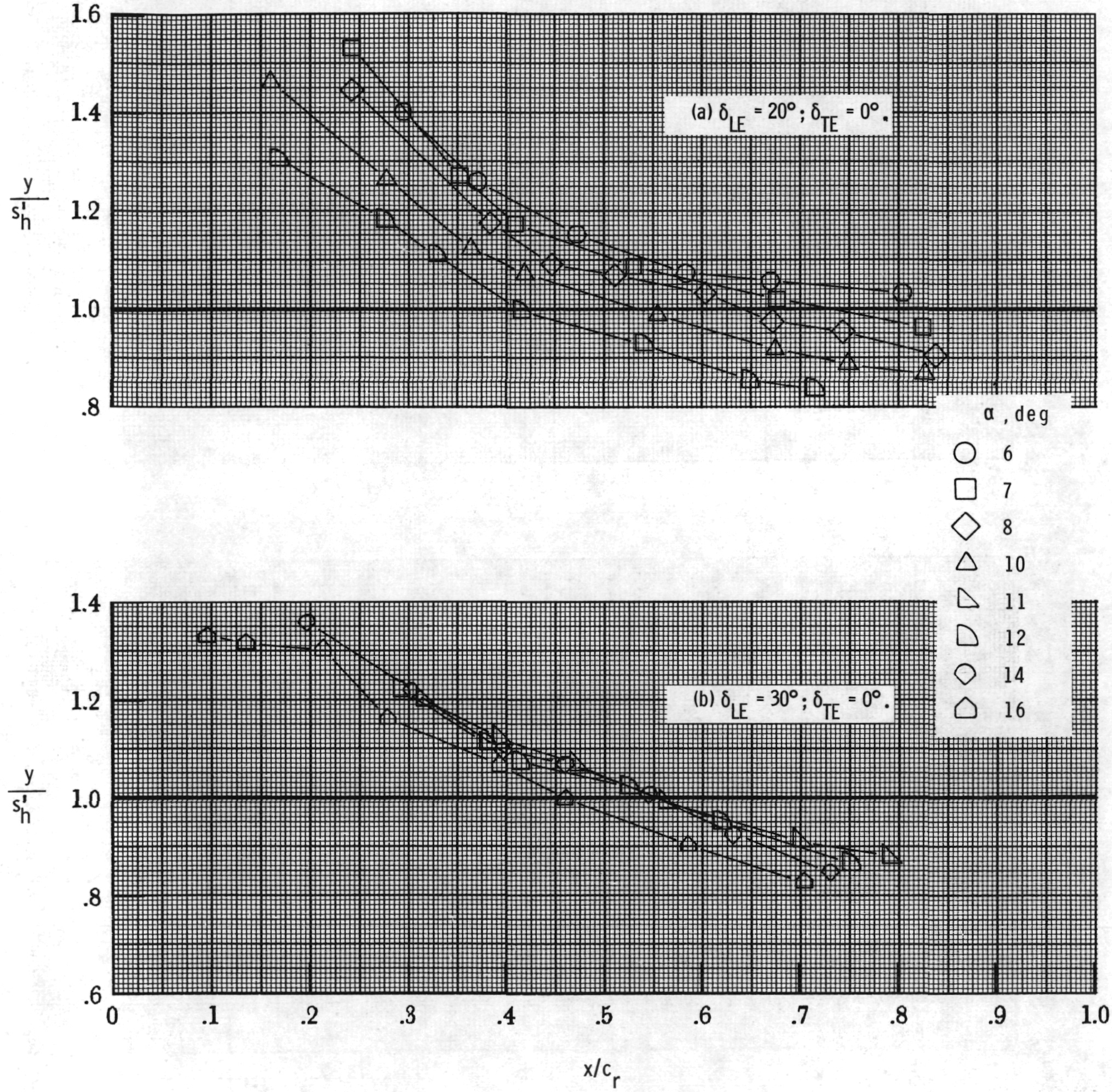


Figure 19.- Primary vortex reattachment data for 74° delta wing with constant-chord LEVF.

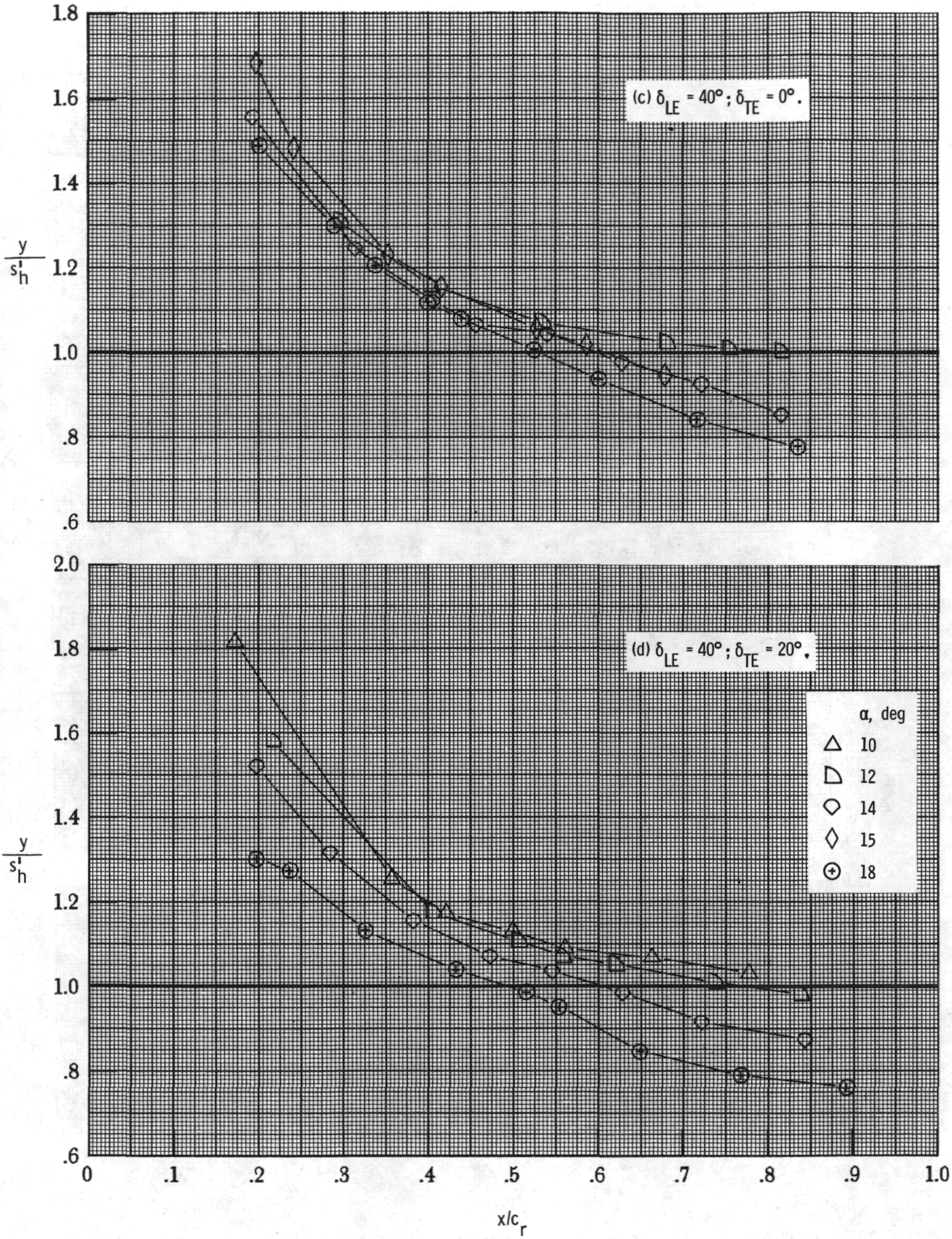


Figure 19.- Concluded.

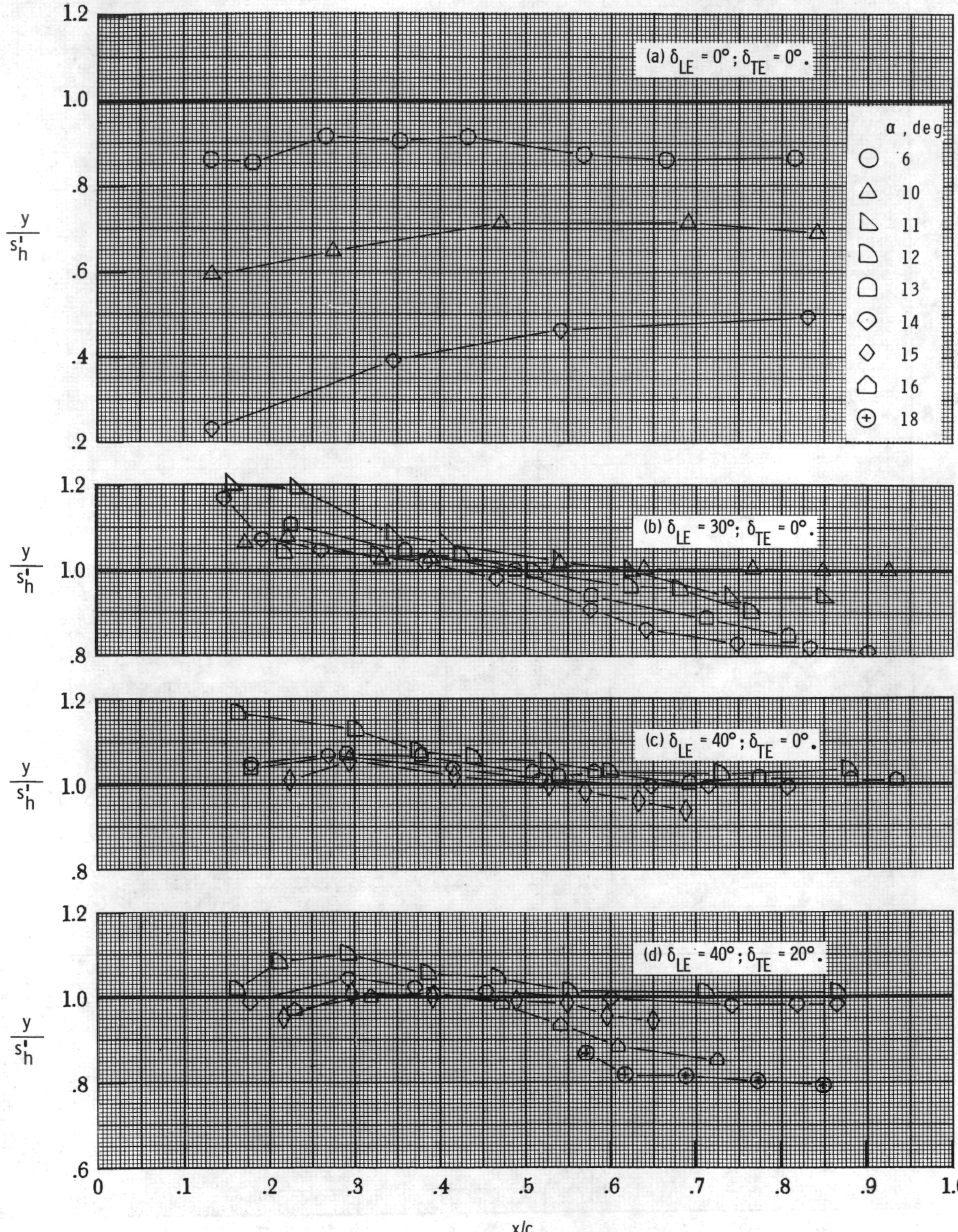


Figure 20.- Primary vortex reattachment data for 74° delta wing with gothic LEVF.

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15. Supplementary Notes

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16. Abstract

Positions of the primary vortex flow reattachment line and longitudinal aerodynamic data were obtained at Mach number 0.3 for a systematic series of vortex flaps on delta wing-body configurations with leading-edge sweeps of 50°, 58°, 66°, and 74°. The investigation was performed to study the parametric effects of wing sweep, vortex flap geometry and deflection, canards, and trailing-edge flaps on the location of the primary vortex reattachment line relative to the flap hinge line. The vortex reattachment line was located via surface oil flow photographs taken at selected angles of attack. Force and moment measurements were taken over an angle of attack range of -1° to 22° at zero sideslip angle for many configurations to further establish the data base and to assess the aforementioned parametric effects on longitudinal aerodynamics. Both the flow reattachment and aerodynamic data are presented.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
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